START

Final

Meeting Minutes Transmittal/Approval
Unit Manager's Meeting: General Topics
740 Stevens Center Room 1200, Richland, Washington
March 24, 1993

FROM/APPROVAL: Robert K. Stewart Date 4/28/93
Robert K. Stewart, R.I. Coordinator, RL (A5-19)

APPROVAL: Pamela S. Innis for Date 04/28/93
Douglas R. Sherwood, Representative, EPA (B5-01)

APPROVAL: Ted A Wooley (for Jack Donnelly) Date 4/28/93
Jack W. Donnelly, Representative, Washington Dept. of Ecology

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The purpose of this meeting was to discuss general topics which are common to all past practices operable units.

Meeting Minutes are attached. Minutes are comprised of the following:

Attachment #1	-	Summary of Meeting and Commitments and Agreements
Attachment #2	-	Attendance List
Attachment #3	-	Agenda for the Meeting
Attachment #4	-	Action Item Status List
Attachment #5	-	Analytical Services Status
Attachment #6	-	Draft Changes to Hanford Tri-Party Agreement Community Relations Plan
Attachment #7	-	Letter from Department of Ecology: Addendum to the WAC 173-160 Requirements of November 6, 1992 Steve Wisness Letter
Attachment #8	-	Review of Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) Handbook Guideline, "Management of Working Groups"
Attachment #9	-	Application of Groundwater Background Data at the Hanford Site: An Interim Approach
Attachment #10	-	Risk Assessment Working Group

Prepared by: Kay Kimmel Date: 4/28/93
Suzanne Clarke, Kay Kimmel, GSSC (A4-35)

Concurrence by: Diana Nickles for Date: 4-28-93
Hal Downey, WHC Coordinator (H6-27)

Attachment #1

Summary of Meeting and Commitments and Agreements

Unit Manager's Meeting: General Topics
March 24, 1993

1. **SIGNING OF THE FEBRUARY UNIT MANAGER'S MEETING MINUTES**

   Minutes were signed with no changes.

2. **ACTION ITEM UPDATE:** (Attachment 4 shows the status of the action items before today's meeting; the updates to Attachment 4 are listed below and the text is highlighted on Attachment 4)

GT.128	No further information.
GT.150	EII 4.3 draft revision nearly complete; to RL by March 30. Strategy portion to be rescoped and incorporated into App. F of the TPA.
GT.151	Closed 03/24/93. Formal letter was received by Regulators.
GT.152	No further information.
GT.154	Closed 03/24/93.
GT.155	Referred to Project Managers.

3. **NEW ACTION ITEMS:**

GT.156 Jeff Lerch	Provide the methodology being used to validate the radionuclide data; indicate how it compares to EPA methods; identify why the data is being rejected by the validators, especially gross alpha data. Action: Jeff Lerch and Suzanne Clarke.
GT.157 Jim Hoover	Identify causes for delay in determination of site-wide contaminant specific background levels.

4. **INFORMATION ITEMS:**

   - <u>Written Copy of Analytical Update</u> - Jeff Lerch provided the update on the laboratories (see attachment #5). Jeff requested that any questions concerning this attachment be directed to him at 509-372-2796.

   - <u>Update of the Tri-Party Agreement Community Relations Plan</u> - Dennis Faulk presented an overview of the draft changes to the Hanford Tri-Party Agreement (see attachment #6). He suggested that it would be suitable to reference this community relations plan in Hanford Site documents, if appropriate, rather than expending the time and effort to produce a new one.

- Application of WAC 173-160 for Drill Holes and Test Pits - Chuck Cline presented an overview and flowchart clarifying Ecology's position concerning requirements for whether a construction activity is a well, a geotechnical test boring, or a test pit (see attachment #7).

- Draft Procedure, Title: Management of Working Groups - Connie Medema distributed copies of the draft protocol for review and comment (see attachment #8). Please provide comments by close of business on April 7, 1993.

- Application of Natural Background Groundwater Data at the Hanford Site: An Approach - Vernon Johnson discussed the status of the project for determining background levels of analytes in Hanford groundwater (see attachment #9). Arsenic was utilized as a test case to describe the technical issues confronted when attempting to determine background levels.

- New Geotechnical Branch: Bob Stewart has been promoted to the position of Branch Chief of the new Geotechnical Branch within the Environmental Restoration Division. The branch will be staffed by U.S. Army Corp of Engineers personnel. Many issues impacting all RL Unit Managers, such as analytical services and risk assessment, will be transferred from the Environmental Restoration Branch to the Geotechnical Branch.

- ERD Temporary Point of Contact for Analytical Issues: Bob Stewart announced that Suzanne Clarke will be the interim point of contact for laboratory issues during the transition of these activities between the Environmental Restoration Branch and the Geotechnical Branch.

- Risk Assessment Working Group - Steve Clark provided a handout discussing the status of the risk assessment working group. See attachment #10.

5. **AGENDA ITEMS FOR APRIL**

   - Signing of March GT Meetings
   - Action Item Status

6. **Next meetings are scheduled** for April 28 and 29, 1993.

May	26 and 27
June	23 and 24

NOTE: During the 300-FF-1 Operable Unit Managers Meeting, Ron Belden (WHC) indicated that requirements for entrance into radiation exclusion zones may involve chest count and bioassay. A new "qualification card" may be required which documents all training that the card holder has.

General Topics Unit Manager's Meeting
Official Attendance Record
March 24, 1993

Please print clearly and use black ink

PRINTED NAME	ORGANIZATION	O.U. ROLE	TELEPHONE
Kay Kimmel	Dames & Moore	GSSC to RL	376-1985
Suzanne E. Clarke	Dames & Moore	GSSC to RL	376-8189
Pamela Innis	EPA	Unit Manager	376-4919
Chuck Cline	Ecology	Hydrogeo	(206) 438-7556
Allan Harris	RL	200-BP-1	(509) 376-4339
Sandra Stubecki	PRC	EPA support	(206) 624-2692
Larry Gadbois	EPA	Unit Manager	509 376-9884
Ward Staubitz	USGS	EPA support	(206) 593-6510
Jim Patterson	WHC	ER Program	509-376-0902
Bob Henckel	WHC	100 Area	509-376-2091
Kevin Kytola	WHC	100 B/C OU's	509-372-1662
Eric Goller	RL	RL 100 Area Unit Mgr	509-376-7326
Dirk Dunning	ODOE	Oregon	503-378-3187
[illegible]	WED	Oregon [illegible]	503-3[illegible]-3455
Jeff Phillips	Ecology	U.M	(509) 736-3011
Dale Donnelly	Ecology	100 Unit Mgr	509-736-3013
Dib Goswami	Ecology	U.M.	509-736-3015
Diane Sickle	WHC	Program/WHC	372-3191
Ted Wooley	Ecology	U.M	736-3012
Richard Carlson	WHC	200/300 Areas	(509) 376-9027
Nancy Uziemblo	Ecology	UM	736 3014
Tom Jones	PNL	OHE	375-2710
Hal Downey	WHC	ER-Programs	376-0565
Dennis Faulk	EPA	UM	376-8631
Bob Stewart	DOE-RL/ERD	Chair, GTUMM	376-6192

Attachment #2

General Topics Unit Manager's Meeting
Official Attendance Record
March 24, 1993

Please print clearly and use black ink

PRINTED NAME	ORGANIZATION	O.U. ROLE	TELEPHONE
FLOYD N. HODGE	WHC	RCRA	376-4627
Vernon G. Johnson	WHC	"	376-0946
CONNIE A. MEDEMA	BCSR		376-7163

Attachment #3

Agenda

Unit Manager's Meeting: General Topics
March 24, 1993

Approval of February General Topics Meeting Minutes - Bob Stewart

Written copy of Analytical Update - Jeff Lerch

Update of the Tri-Party Agreement Community Relations Plan - Dennis Faulk

"Application of 160 for Drill Holes and Test Pits" Overview WAC-173-160 - Chuck Cline

Draft Procedure, Title: Management of Working Groups - Connie Medema (Please provide comments within two weeks to Frank Calapristi)

"Application of Natural Background Groundwater Data at the Hanford Site: An Approach" - Vernon Johnson

Action Item Status, Meeting Recap, April UMM - Suzanne Clarke

Attachment #4

Action Items Status List
Unit Manager's Meeting: General Topics
March 24, 1993

ITEM NO.	ACTION/SOURCE OF ACTION	STATUS
GT.38	If possible, at the May Unit Manager's Meeting a presentation on the approved, preferred alternative method for disposal of the reactors will be given. Action: Jim Goodenough (4/18/90, GT-UMM)	Closed 02/23/93.
GT.128	Provide information on the date when Analytical Data Strategy document will be provided to Ecology and EPA. (2/26/92). Action: Jim Goodenough.	Open. To remain open pending outcome of meeting on 3/26/92. Eric Goller will give status of item at May UMM (4/22/92). Currently in RL review. The paper will be provided to EPA and Ecology upon satisfactory resolution of all RL comments. Pending formal transmittal (6/24/92). In internal DOE/RL review process (7/29/92). Comments have been submitted (10/21/92). This issue needs to be revisited, with a new actionee (01/27/93).
GT.149	Provide the report for the mid-October assessment of the Weston laboratory. Action: Jeff Lerch (WHC).	Closed 02/23/93.
GT.150	Work with Frank Calapristi to incorporate the Investigation Derived Waste Management Strategy into Appendix F of the TPA. Action: Bob Hobbs (WHC). 01/27/93.	Open. EII 4.3 draft revision nearly complete; to RL by March 30. Strategy portion to be rescoped and incorporated into App. F of the TPA.
GT.151	Write a letter to EPA and Ecology stating that a response to comments on the groundwater background report will be provided upon completion of the EPA and Ecology submittal of comments on Appendix D. Also, provide a final date when the document will be completed. Action: Fred Ruck (WHC). 01/27/93.	Closed 03/24/93.

ITEM NO.	ACTION/SOURCE OF ACTION	STATUS
GT.152	Initiate the action to establish a working group to develop background parameters for radionuclides. Action: Bob Stewart (RL). 01/27/93.	Open.
GT.153	Provide a list of all of integrated demonstrations and provide a 30 minute briefing describing the INEL integrated demo. Action: Joan Woolard (WHC). 01/27/93.	Closed 02/23/93.
GT.154	Resolve internal issues and provide a report to the regulators concerning groundwater site-background concentrations at the February Unit Manager's Meeting. Action: Mike Thompson (RL). 01/27/93.	Closed 03/24/93.
GT.155	Provide the Regulators with a copy of the new Request for Proposal (RFP) for commercial laboratory services as soon as it is completed in order to verify that the RFP is in compliance with the M-14 settlement. Action: Jeff Lerch.	Open. Referred to Project Managers.
GT.156	Provide the methodology being used to validate the radionuclide data; indicate how it compares to EPA methods; identify why the data is being rejected by the validators, especially gross alpha data. Action: Jeff Lerch and Suzanne Clarke.	Open 03/24/93.
GT.157	Identify causes for delay in determination of site-wide contaminant specific background levels. Action: Jim Hoover.	Open 03/24/93.

ANALYTICAL SERVICES STATUS

Attachment #5

March 24, 1993

Commercial Laboratories

- Purchase Requisition documentation for contract extensions at various stages of RL and WHC review.
  - Extension period through March 1994.

- DataChem and S-Cubed have small workloads and little or no backlog.

- TMA backlog elevated due to carryover from samples submitted in September 1992.
  - Backlog reduced by one-third from January 1993 reporting month.
  - Full recovery projected for March 1993 reporting month.
  - Reporting of sample backlog resulted in slight increase to average turnaround time.

Commercial Laboratories (continued)

- TMA/Skinner and Sherman assessment scheduled for March 24-25, 1993.
- TMA personnel planning to visit Hanford Site in April 1993.
- Weston/Teledyne personnel visited Hanford Site week of March 8, 1993.
- Weston average turnaround times within TPA criteria for complete data received during last four reporting months.

Analytical Services Procurement

- Amended RFP issued February 1993.
- Technical Proposals due April 9, 1993.
- July 1993 target award date.

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LABORATORY A TURNAROUND TIME SUMMARY - 02/25/93

03/06/93

	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	
# Samples Submitted	0	2	2	11	66	33	50	97	41	24	39	

Performance by Month Samples Submitted												
# Samples Completed	N/A	2	2	11	66	29	50	92	41	22	0	
Shipping Time	N/A	9	2	3	6	9	10	9	5	8	7	
Analysis Time	N/A	44	24	21	24	*	28	*	30	*	*	
Turnaround Time	N/A	52	26	24	30	*	38	*	35	*	*	

Performance by Month Complete Data Received												
# Samples Completed	4	0**	3	1	73	8	6	62	78	62	25	
Shipping Time	3	N/A	6	2	5	3	9	11	8	8	9	
Analysis Time	34	N/A	33	36	22	19	29	31	35	38	36	
Turnaround Time	37	N/A	39	38	27	22	38	42	43	46	45	

*Will not be calculated until all data is complete for the subject month
(# samples submitted = # samples completed)

**No sample data due

Monthly Sample Backlog[1]		0	0	0	0	2	9	10	22	14	10	

[1]Backlog defined as samples which have been at Laboratory A for >35 calendar days.

LABORATORY B TURNAROUND TIME SUMMARY - 02/25/93

03/06/93

	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	
# Samples Submitted	24	79	70	36	37	21	5	32	21	40	65	

Performance by Month Samples Submitted												
# Samples Completed	24	79	70	36	37	21	5	32	21	40	10	
Shipping Time	11	3	4	46	3	3	1	27	2	6	2	
Analysis Time	10	24	21	28	62	32	10	23	21	21	*	
Turnaround Time	23	32	25	74	65	35	11	50	23	27	*	

Performance by Month Complete Data Received												
# Samples Completed	1	10	98	47	36	12	22	33	38	22	43	
Shipping Time	7	5	5	4	46	23	2	2	25	7	4	
Analysis Time	10	18	19	28	26	37	30	63	23	21	22	
Turnaround Time	17	23	24	32	72	60	32	65	48	28	26	

*Will not be calculated until all data is complete for the subject month
(# samples submitted = # samples completed)

Monthly Sample Backlog[1]	[illegible]	0	0	20	0	29	29	0	0	0	0	

[1]Backlog defined as samples which have been at Laboratory B for >35 calendar days.

95129[illegible]31663

LABORATORY C TURNAROUND TIME SUMMARY - 02/25/93

03/06/93

	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	
# Samples Submitted	151	70	77	178	110	189	247	114	79	31	259	

Performance by Month Samples Submitted												
# Samples Completed	151	70	77	178	110	173	219	108	68	21	6	
Shipping Time	3	3	4	4	3	7	3	4	3	6	3	
Analysis Time	89	76	52	59	57	*	*	*	*	*	*	
Turnaround Time	92	79	56	63	60	*	*	*	*	*	*	

Performance by Month Complete Data Received												
# Samples Completed	68	150	103	135	204	226	171	191	204	127	81	
Shipping Time	5	3	3	4	4	10	14	3	3	3	3	
Analysis Time	126	135	122	120	121	132	88	55	63	70	61	
Turnaround Time	131	138	125	124	125	142	102	58	66	73	64	

*Will not be calculated until all data is complete for the subject month (# samples submitted = # samples completed)

Monthly Sample Backlog[1]		314	340	291	198	106	29	53	113	67	61	

[1]Backlog defined as samples which have been at Laboratory C for >60 calendar days.

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LABORATORY D TURNAROUND TIME SUMMARY - 02/25/93

03/06/93

	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	
# Samples Submitted	106	304	103	114	218	530	195	286	239	115	206	

Performance by Month Samples Submitted												
# Samples Completed	106	304	103	114	218	530	194	215	131	0	7	
Shipping Time	5	3	3	8	5	8	6	6	4	4	3	
Analysis Time	75	88	77	70	84	82	*	*	*	*	*	
Turnaround Time	80	91	80	78	89	90	*	*	*	*	*	

Performance by Month Complete Data Received												
# Samples Completed	203	148	338	155	348	192	143	239	307	316	311	
Shipping Time	6	29	57	5	10	5	4	5	11	4	4	
Analysis Time	116	195	168	150	103	86	72	84	76	83	95	
Turnaround Time	122	224	225	155	113	91	76	89	87	87	99	

*Will not be calculated until all data is complete for the subject month
(# samples submitted = # samples completed)

Monthly Sample Backlog[1]		363	230	361	108	46	125	399	284	281	180	

[1]Backlog defined as samples which have been at Laboratory D for >60 calendar days.

ISSUE	1990 COMMUNITY RELATIONS PLAN	DRAFT CHANGES TO HANFORD TRI-PARTY AGREEMENT COMMUNITY RELATIONS PLAN
TOLL-FREE NUMBER	Not included.	You can call 1-800-321-2008, to get information about Hanford Tri-Party Agreement cleanup and compliance. It should be noted, that the agencies implemented a toll free line, April 1992.
MAILING LISTS	Currently the agencies maintain one mailing list.	The agencies are proposing two mailing lists: one list would be for individuals who would like to be involved with cleanup and compliance, and the other for individuals who would like to be informed.
HANFORD TRI-PARTY AGREEMENT PUBLIC MEETINGS Annual Meetings	Not included.	The purpose of the Hanford Tri-Party Agreement public meetings will be to review cleanup progress or changes in schedules made during the past year, as well as outline decisions and actions for the coming year. Instead of the three agencies talking with communities in Washington and Oregon on a quarterly basis, in the Spring of each year, there will be meetings in key cities in Washington and Oregon. The purpose of the Hanford Tri-Party Agreement public meetings is to better respond to communities and inform and involve them with Hanford cleanup issues. The agencies believe this will benefit communities more than simply a two-hour public meeting in their communities once a year.
HANFORD TRI-PARTY AGREEMENT QUARTERLY PUBLIC MEETINGS	Meetings to discuss upcoming and previous quarters' activities. In the 1990 Community Relations Plan, each quarterly meeting was to be conducted in the Tri-Cities and in one other location. Each year, the three agencies were to evaluate the locations and frequency of the meetings and determine if changes should be made.	The quarterly public meetings will be conducted each quarter in the Tri-Cities. The meetings will cover significant cleanup and compliance issues, cleanup accomplishments, and the status of cleanup schedules. Previously, the meetings were termed "Quarterly Public Meetings," but were conducted only quarterly in the Tri-Cities and once a year in another community. As described above, the Hanford Tri-Party Agreement public meetings will be a larger, more comprehensive meeting than addressed by the quarterly public meetings.

PUBLIC OUTREACH ACTIVITIES	Not included.	USDOE, EPA, and Ecology are attempting to increase efforts to talk informally with people and provide individuals and organizations with information regarding cleanup and compliance. These informal public outreach activities would include public meetings, workshops, open houses, and meetings with local governments and organizations.
LEVELS OF DECISIONS BEING MADE AT HANFORD AND OPPORTUNITIES FOR PUBLIC PARTICIPATION	Not included.	The agencies are proposing a new section to the Community Relations Plan, "Levels of Decisions Being Made at Hanford and Opportunities for Public Participation." This is in response to people's questions about how public comments impact decisions at Hanford. The section discusses the Hanford Tri-Party Agreement change request process, Resource Conservation and Recovery Act, and Comprehensive Environmental Recovery, Compensation, and Liability Act decisions.
CRITERIA FOR INITIATING PUBLIC COMMENT ON CHANGES TO THE AGREEMENT	If the agencies determined change was significant, public comment period was conducted.	USDOE, EPA, and Ecology will determine the need for and level of public information and involvement based on the following criteria: • Draft change is proposed for a major milestone. • Draft change could have a significant impact on human health and the environment. • Draft change could have a significant impact toward maintaining and fulfilling important Hanford cleanup objectives and Tri-Party Agreement milestones. • Draft change could have an impact on interested parties, including Native Americans, labor unions, Tri-Cities community, and Hanford public interest groups. • Draft change is proposed under a law or regulation that stipulates public involvement. Note: No single criteria Alone necessarily triggers Public Comment

CHANGE REQUEST PROCESS	Not included, however, the process for public comment involved soliciting comments after the agencies reached concurrence on issues.	Twice in the process, the agencies are asked to make a determination of whether the proposed change is significant. Each time, if they conclude that the change is significant, they will then initiate a process for involving the public. The agencies are proposing to involve "interested parties" earlier. If the agencies determine that a proposed change to the Agreement is significant, then there will be some form of public involvement. The goal of this change is to involve the public in Hanford cleanup decisions, *before* the agencies concur on a resolution.

granted variance from this requirement for test pits, as long as the material placed back into the pits has been compacted by excavation machinery.

As of this date, test pits will be considered to be excavations that are excluded from WAC 173-160 regulations except as provided under WAC 173-160-010(4). WAC 173-160-010(4) stipulates that, pursuant to chapter 90.48 RCW, "those excavations excluded in subsection (3)(a) through (h) of this section shall be constructed and abandoned to ensure protection of the ground water resource and to prevent the contamination of that resource." **The construction and abandonment of test pits will be described in the appropriate Description of Work (DOW) that precedes any work conducted at Hanford for characterization and other associated purposes (RCRA or CERCLA).** These DOWs are normally reviewed by Ecology and/or by EPA and signed-off prior to any construction activities. Provided the material placed back into the test pits undergoes compaction by excavation machinery in lifts as prespecified in the DOWs and construction is described, no additional variance will be required for test pit construction or abandonment.

By excluding the test-pit excavations from WAC 173-160 and placing this construction method under WAC 173-160-010(4), does not preclude other methods that would qualify as WAC 173-160 regulated construction. In summary, the categories that would exist at Hanford are as follows:

1) Wells - Defined as any "excavation that is drilled, cored, bored, washed, driven, dug, jetted, or otherwise constructed when the intended use of an excavation is for location, diversion, artificial recharge, or withdrawal of ground water. Well includes water-supply well and resource protection well. Well does not mean excavations excluded in WAC 173-160-010(3)." All wells are regulated under WAC 173-160.

    A) Water Supply Well - Defined as "any well that is used to withdraw, dewater, or recharge ground water."

    B) Resource Protection Well - Defined as "monitoring wells, observation wells, piezometers and spill response wells, and cased geotechnical test borings."

2) WAC 173-160-010(3)(g) excluded wells - Defined as "Uncased wells used **for dewatering purposes in construction work, and other uncased excavations, such as uncased geotechnical test borings. However, the provisions of WAC 173-160-055, 173-160-010(4), and 173-160-420 shall apply." Although, by definition, a geotechnical test boring is considered to be a "temporary" cased borehole; at Hanford, Ecology will consider that a geotechnical test boring constructed with casing that will be removed within one year is "uncased" and will fall under this category.**

3) WAC 173-160-010(3)(a)-(h) excluded wells - Required to meet only WAC 173-160-010(4) **requirements that shall be constructed and abandoned** "to **ensure protection of the ground water resource and to prevent the contamination of that resource." These include; excavations that are not used to locate, divert, artificially recharge, or withdraw ground water; postholes; landfill gas-extraction wells; excavations used for**

granted variance from this requirement for test pits, as long as the material placed back into the pits has been compacted by excavation machinery.

As of this date, test pits will be considered to be excavations that are excluded from WAC 173-160 regulations except as provided under WAC 173-160-010(4). WAC 173-160-010(4) stipulates that, pursuant to chapter 90.48 RCW, "those excavations excluded in subsection (3)(a) through (h) of this section shall be constructed and abandoned to ensure protection of the ground water resource and to prevent the contamination of that resource." **The construction and abandonment of test pits will be described in the appropriate Description of Work (DOW) that precedes any work conducted at Hanford for characterization and other associated purposes (RCRA or CERCLA).** These DOWs are normally reviewed by Ecology and/or by EPA and signed-off prior to any construction activities. Provided the material placed back into the test pits undergoes compaction by excavation machinery in lifts as prespecified in the DOWs and construction is described, no additional variance will be required for test pit construction or abandonment.

By excluding the test-pit excavations from WAC 173-160 and placing this construction method under WAC 173-160-010(4), does not preclude other methods that would qualify as WAC 173-160 regulated construction. In summary, the categories that would exist at Hanford are as follows:

1) Wells - Defined as any "excavation that is drilled, cored, bored, washed, driven, dug, jetted, or otherwise constructed when the intended use of an excavation is for location, diversion, artificial recharge, or withdrawal of ground water. Well includes water-supply well and resource protection well. Well does not mean excavations excluded in WAC 173-160-010(3)." All wells are regulated under WAC 173-160.

    A) Water Supply Well - Defined as "any well that is used to withdraw, dewater, or recharge ground water."

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3) WAC 173-160-010(3)(a)-(h) excluded wells - Required to meet only WAC 173-160-010(4) requirements that shall be constructed and abandoned "to ensure protection of the ground water resource and to prevent the contamination of that resource." These include; excavations that are not used to locate, divert, artificially recharge, or withdraw ground water; postholes; landfill gas-extraction wells; excavations used for

Mr Steven H. Wisness
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February 22, 1993

obtaining or prospecting for oil, natural gas, minerals, products of mining, quarrying, as provided in chapter 78.52 RCW; injection wells, such as stormwater disposal or recharge wells regulated in chapter 173-218 WAC; cathodic protection wells; and infiltration galleries, trenches, ponds, pits, and sumps.

The previous 15 ft depth requirement will no longer be applicable at Hanford. It was primarily of use in limiting test pit regulatory requirements. Since test pits have been relegated to a different category, this limitation is no longer necessary. **The uncased geotechnical test borings (such as uncased cone penetrometer holes) shall meet the category 2) requirements regardless of whether they are completed shallower than 15 ft.**

It is the **Department's interpretation that these requirements will apply only to the Hanford Site.** They are consistent with what is being applied throughout the State of Washington, but should not be considered limiting and do not preclude other interpretations in other regions of the State of Washington. The conditions at Hanford are not the same as in the western part of the State, or even in other areas of eastern Washington and certain other site-specific requirements may be applicable in those areas.

I have included a flow chart with this letter that should be helpful in making well and borehole decisions. If you have any questions, please contact me at (206) 438-7556.

Sincerely,

Charles S. Cline

Charles S. Cline
Hydrogeologist
Nuclear & Mixed Waste Management Program

CC:lj

Enclosure

cc: Paul Day, EPA-Hanford
Doug Sherwood, EPA-Hanford
R.D. Wojtasek, WHC
D.J. Moak, WHC
Tom Mackie, Ecology-CRO
Dick Szymarek, Ecology
Dave Jansen, Ecology
Dave Nylander, Ecology
Larry Goldstein, Ecology
Tom Tebb, Ecology
Darci Teel, Ecology
Krystyna Kowalik, Ecology

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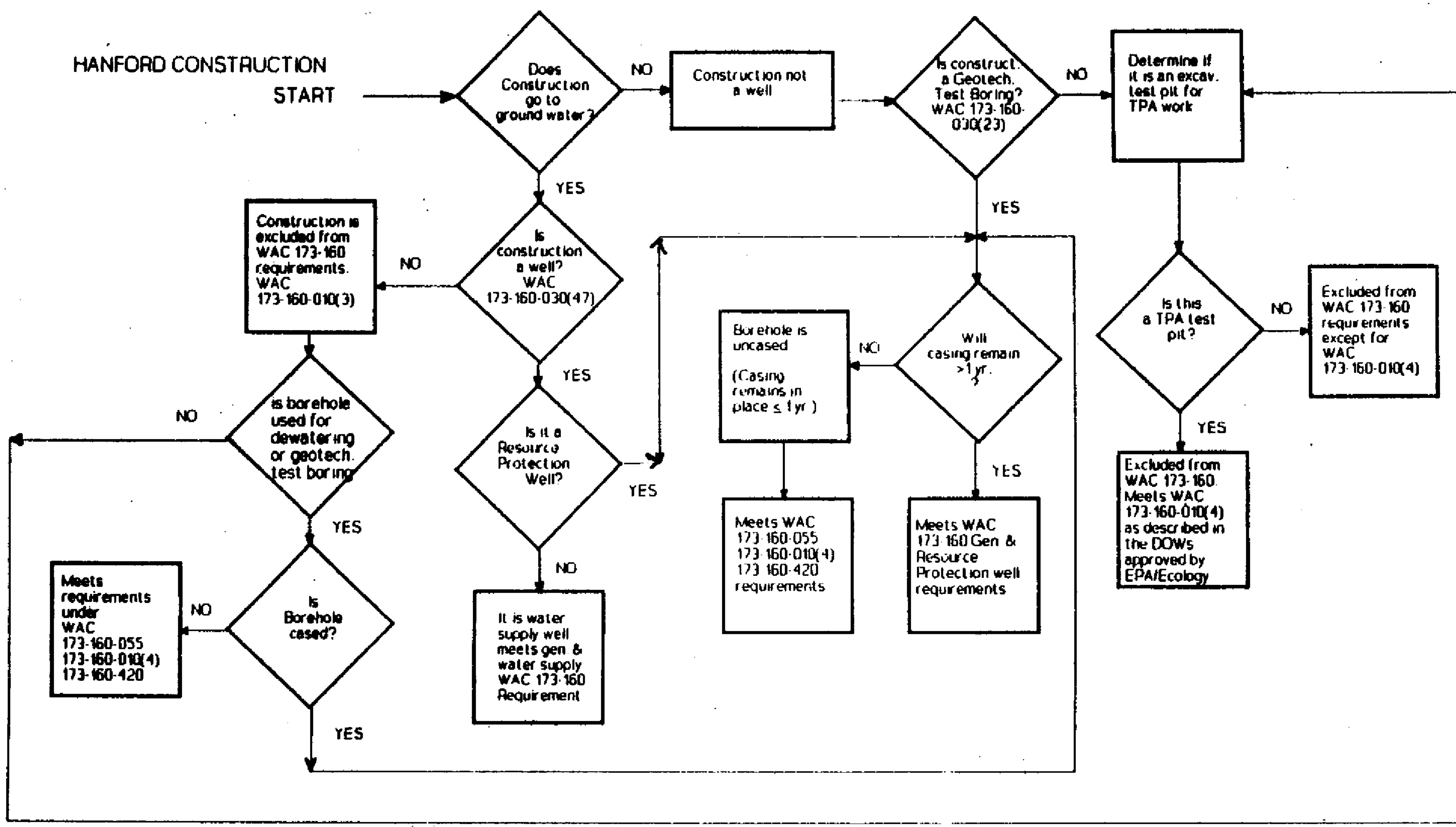

HANFORD CONSTRUCTION
START
Does Construction go to ground water?
NO
Construction not a well
Is construct. a Geotech. Test Boring? WAC 173-160-030(23)
NO
Determine if it is an excav. test pit for TPA work
YES
Is construction a well? WAC 173-160-030(47)
NO
Construction is excluded from WAC 173-160 requirements. WAC 173-160-010(3)
YES
YES
Will casing remain >1 yr.?
NO
Borehole is uncased (Casing remains in place ≤ 1 yr.)
Is this a TPA test pit?
NO
Excluded from WAC 173-160 requirements except for WAC 173-160-010(4)
Is borehole used for dewatering or geotech. test boring
NO
YES
Is it a Resource Protection Well?
YES
YES
YES
Excluded from WAC 173-160. Meets WAC 173-160-010(4) as described in the DOWs approved by EPA/Ecology
Meets WAC 173-160-055 173-160-010(4) 173-160-420 requirements
Meets WAC 173-160 Gen & Resource Protection well requirements
NO
Is Borehole cased?
NO
Meets requirements under WAC 173-160-055 173-160-010(4) 173-160-420
It is water supply well meets gen. & water supply WAC 173-160 Requirement
YES

#7/Page 4 of 4

DON'T SAY IT --- *Write It!*

DATE: March 24, 1993

TO: Distribution

FROM: Frank T. Calapristi B2-35
Telephone: 6-6693

cc: B. A. Austin B2-35
L. E. Michael H6-08
FTC/LB File

SUBJECT: REVIEW OF HANFORD FEDERAL FACILITY AGREEMENT AND CONSENT ORDER (TRI-PARTY AGREEMENT) HANDBOOK GUIDELINE, "MANAGEMENT OF WORKING GROUPS"

Enclosed, for your review, is a new guideline. It will be included in the *Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) Handbook*, TPA-RL-90-0001.

Please review this guideline and return comments to Lee Michael (MSIN H6-08) by April 7, 1993. If you have any questions or require additional information, please contact me at 6-6693. In the event comments are not received by the above referenced date, I will assume your concurrence.

rjt

Enclosure

TRI-PARTY AGREEMENT HANDBOOK	**Document Number**	RL-TPA-90-0001
	Guideline Number	TPA-MG-12
MANAGEMENT GUIDELINES	**Revision**	DRAFT A
	Page	1 of 7
	Effective Date	DRAFT 03/24/93

TITLE:

Management of Working Groups

APPROVED BY:

S.H. Wisness, Hanford Project Manager
U.S. Department of Energy

P.T. Day, Hanford Project Manager
U.S. Environmental Protection Agency

R.F. Stanley, Hanford Project Manager
State of Washington
Department of Ecology

1.0 PURPOSE

This procedure establishes the requirements and responsibilities, and defines the process to establish a formal working group. It also defines the methods by which issues and decisions resulting from working group discussions are identified, acted upon, tracked and reported.

2.0 DEFINITIONS

Action Plan: A document developed by the working group which outlines the scope, schedule and budget required to resolve an issue(s) undertaken by the committee.

Agency Leads: Designated individuals from U.S. Department of Ecology (Ecology) and U.S. Environmental Protection Agency (EPA), who are members of the working group, and have been assigned to lead (or point of contact) the committee.

Charter: A document which grants the working group the authority to meet and discuss alternative solutions for a particular problem or problem area.

Committee Chair: A designated individual, who is a member of the working group, and has been assigned to lead (or point of contact) the committee.

Project Manager: Designated individuals assigned by each party to implement the overall scope, terms, and conditions of the Tri-Party Agreement as it applies to the Hanford Site.

Working Group: A committee whose members constitute, at minimum, one representative from each of the signatories to the Tri-Party Agreement. The committee may be formed to achieve one or both of the following goals: facilitate achievement of a TPA Milestone or be a standing committee to facilitate consensus on technical or functional issues.

Working Group Coordinator: A designated U.S. Department of Energy (DOE) staff member who will act as a single point of contact to coordinate the management of all working groups.

3.0 SCOPE

This procedure applies to all DOE, EPA, Ecology, and contractor personnel assigned to or responsible for the management of a Tri-Party Agreement working group.

4.0 RESPONSIBILITIES

4.1 Division Director With Lead Responsibility

The duties and responsibilities of the DOE Division Director with lead responsibility are as follows:

- Appoint the Working Group Coordinator.
- Authorize for DOE, the formation of a working group based on the recommendations of the Working Group Coordinator and concurrence of the EPA and Ecology Program Managers.
- Authorize DOE Leads (usually Chair).

4.2 EPA and Ecology Project Managers

The duty and responsibility of the EPA and Ecology Project Managers is to concur, for their respective agencies, the formation of a Working Group and designate lead agency participants.

4.3 DOE Project Manager

The duty and responsibility of the DOE Project Manager is to concur on DOE Division Director actions taken per 4.1 above.

4.4 Working Group Coordinator

The duties and responsibilities of the Working Group Coordinator are as follows:

- Be the point of contact for all inquiries concerning the formation of new working groups.
- Coordinate the development of the working group charter, and assignment of the committee chair.

- Ensure that the status of each working group is provided at the General Topics Session of the monthly CERCLA/Past Practices or treatment, storage, and disposal (TSD) Unit Managers Meeting (GT-UMM).

- Reconstruct the historical record (summary) of past working groups from 1988 to the present.

4.5 Committee Chair

The duties and responsibilities of the committee chair are as follows:

- Prepare the working group charter and determine (or coordinate the determination of) the, full committee membership (members other than Lead representatives for each agency).

- Convene the working group as deemed necessary and appropriate.

- Report to the working group coordinator all planned committee meetings and meeting agendas.

- Provide monthly status updates at the GT-UMM with the assistance of the working group coordinator.

- Assignment of an individual(s) of the working group to prepare an action plan(s).

- Preparation of Action Plans.

4.6 Committee Members

The duty and responsibility of the committee members is to present issues to the working group for discussion and to assist in their resolution.

5.0 REQUIREMENTS

Each working group shall posses a charter that outlines the mandate the committee will operate under.

Action plans shall be developed, as necessary, to provide direction to the working group in resolving issues and to report progress against.

A monthly report shall be prepared by each working group to status the progress of the committee and all action plans. A summary report shall be prepared monthly, at the Working Group Coordinator level, for presentation at the monthly CERCLA/Past Practice or TSD GT-UMM.

6.0 PROCEDURE

6.1 Formation of the working committee(s)

6.1.1 The Working Group Coordinator shall review all proposals/requests for the formulation of a working group and recommend if such a group should be conceived. This recommendation shall be developed in consultation with EPA and Ecology representatives (usually discussed at the UMMs).

6.1.2 The following criteria shall be used by the Working Group Coordinator for determining whether the proposed working group should be constituted:

- Do the elements require agreement by all three parties of the Tri-Party Agreement?
- Do the functional elements fall outside the scope of the existing Tri-Party Agreement operable unit or TSD process?
- Is the element truly a functional item versus a programmatic item?
- Is there a need to resolve issues or reach consensus decisions within the functional element?

6.1.3 Based on the criteria presented in item 6.1.2 above, the Working Group Coordinator shall present all findings to the Lead DOE Division Director, EPA and Ecology Project Managers and provide recommendations whether the group should be formulated.

6.1.4 If the decision is to form a working group, the DOE Division Director shall authorize the formulation of new working groups with concurrence from the EPA and Ecology Project Managers.

6.2 Charter preparation

6.2.1 The Working Group Coordinator in coordination with EPA and Ecology representatives, shall select an individual to chair the group.

6.2.2 The Committee Chair shall coordinate the determination of the full committee membership.

6.2.3 With the assistance of the Committee Members, the Committee Chair shall prepare a charter which is consistent with the outline provided in Attachment 1.

6.2.4 The Working Group Coordinator shall review and approve all charters.

6.3 Action plan preparation

6.3.1 The Committee Chair shall assign responsibility for development of an action plan(s) to an individual(s) member of the working group.

6.3.2 The plan(s) shall be prepared in a format which addresses the following:

- Responsibility
- Issues(s) to be resolved
- ~~Proposed Cost Account Plan (CAP)~~ Delete SEC
- Proposed Schedule(s) and Deliverable(s)
- Resource Requirements
- Approach
- Interfaces

6.4 Monthly Report Preparation

6.4.1 Each month the Committee Chair shall provide the Working Group Coordinator with a report that documents the status of the working group.

6.4.2 The monthly working group report shall document all outstanding issues, recent decisions and list the appropriate points of contact. The format of the report shall be consistent with the Attachment 2.

6.4.2 Each month, the Working Group Coordinator shall be responsible for preparing a report that documents the status of all working groups. Input from the individual reports prepared by the Committee Chairs are to be basis of this report.

6.4.3 When requested, the Working Group Coordinator shall be responsible for the presentation of the status of each working group at the GT-UMM.

7.0 REFERENCES

Ecology, EPA, and DOE, 1992, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia Washington.

9 3 1 2 5 1 3 7 8

Attachment 1

I. CHARTER

A. Purpose

B. Scope and Responsibilities

C. Stipulations

D. Chair/Tri-Party Leads membership

- For contractor

  - Deliverables
  - Working group termination date (planned)

Attachment 2

(title of working group)
CONSTITUTED JOINT WORKING GROUP
HANFORD ENVIRONMENTAL RESTORATION PROGRAM
STATUS REPORT FOR
(include month and year)

Leads			
DOE-RL Lead	EPA Lead	Ecology Lead	Contractor Leads
PH:	PH:	PH:	PH:
Other Members			
Charter:			
Issues:			
Decisions:			
Deliverables:			
Notes: Date working group formed - Planned termination date - Working group completed task in 19xx			

APPLICATION OF GROUNDWATER BACKGROUND DATA AT THE HANFORD SITE: AN INTERIM APPROACH

Unit Managers Meeting Handout

Revised February 22, 1993

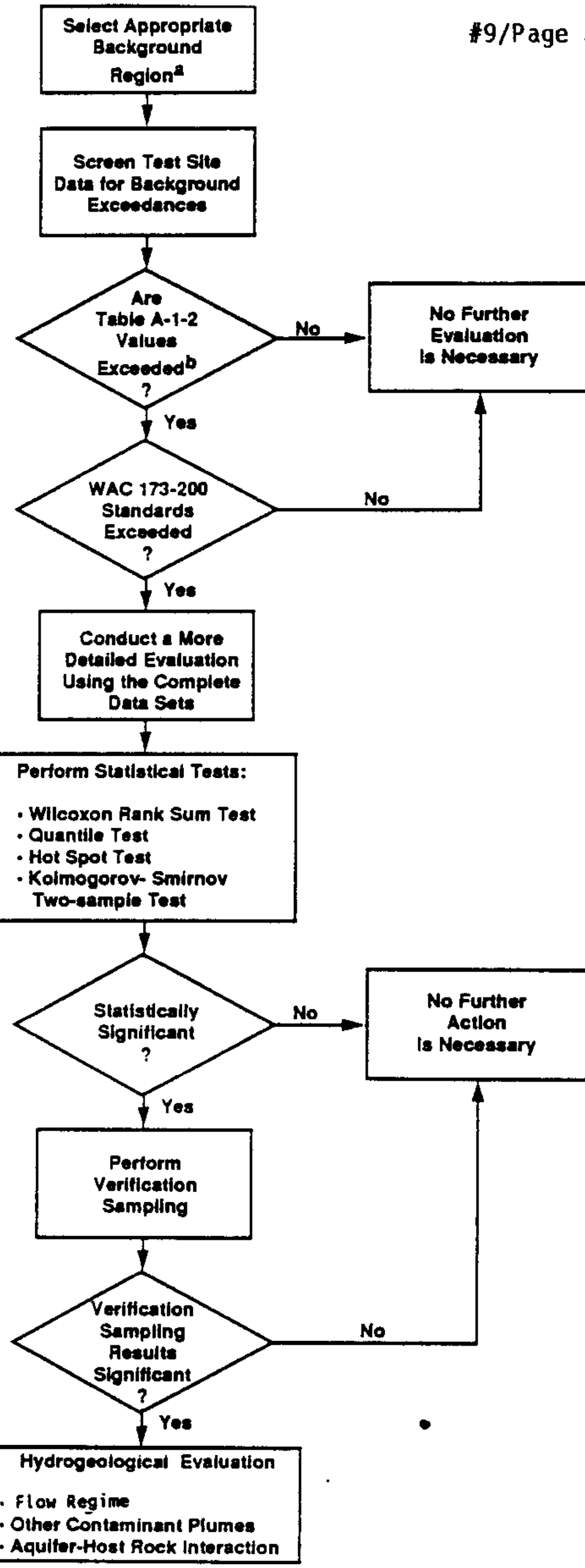
BACKGROUND AND PURPOSE:

- Demonstrate an approach for interim use of existing "natural" background data in groundwater impact assessments at active wastewater disposal sites

- Illustrate application of Ecology's statistical guidance at the Hanford Site and some potential problems

- Suggest some possible alternatives for site-specific guidance

SUMMARY OF PROPOSED APPROACH

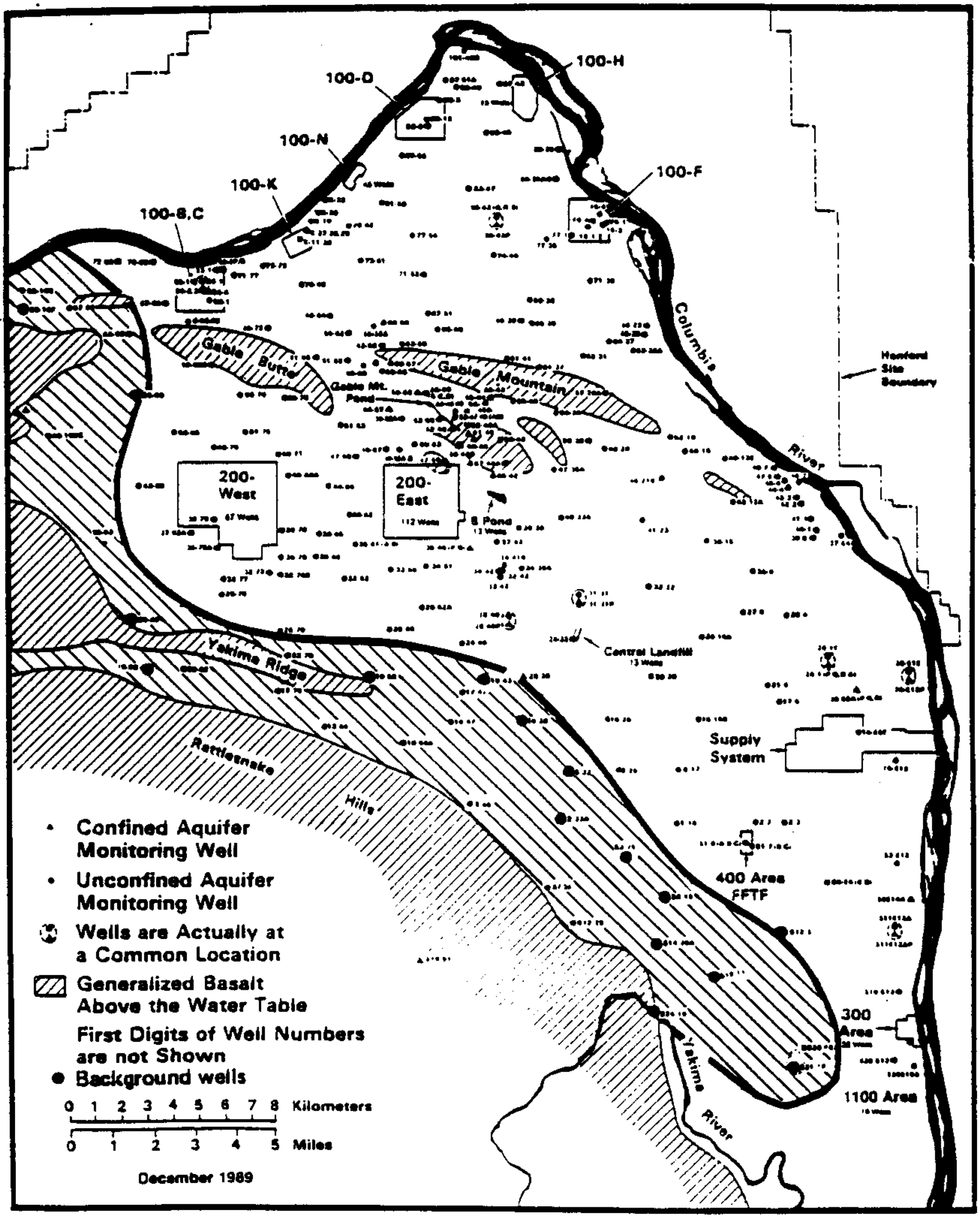


[a]Concensus Among DOE, WHC, EPA, and Ecology (Work in Progress)

[b]Ecology Allows a 20% Exceedance of Background Based Standards

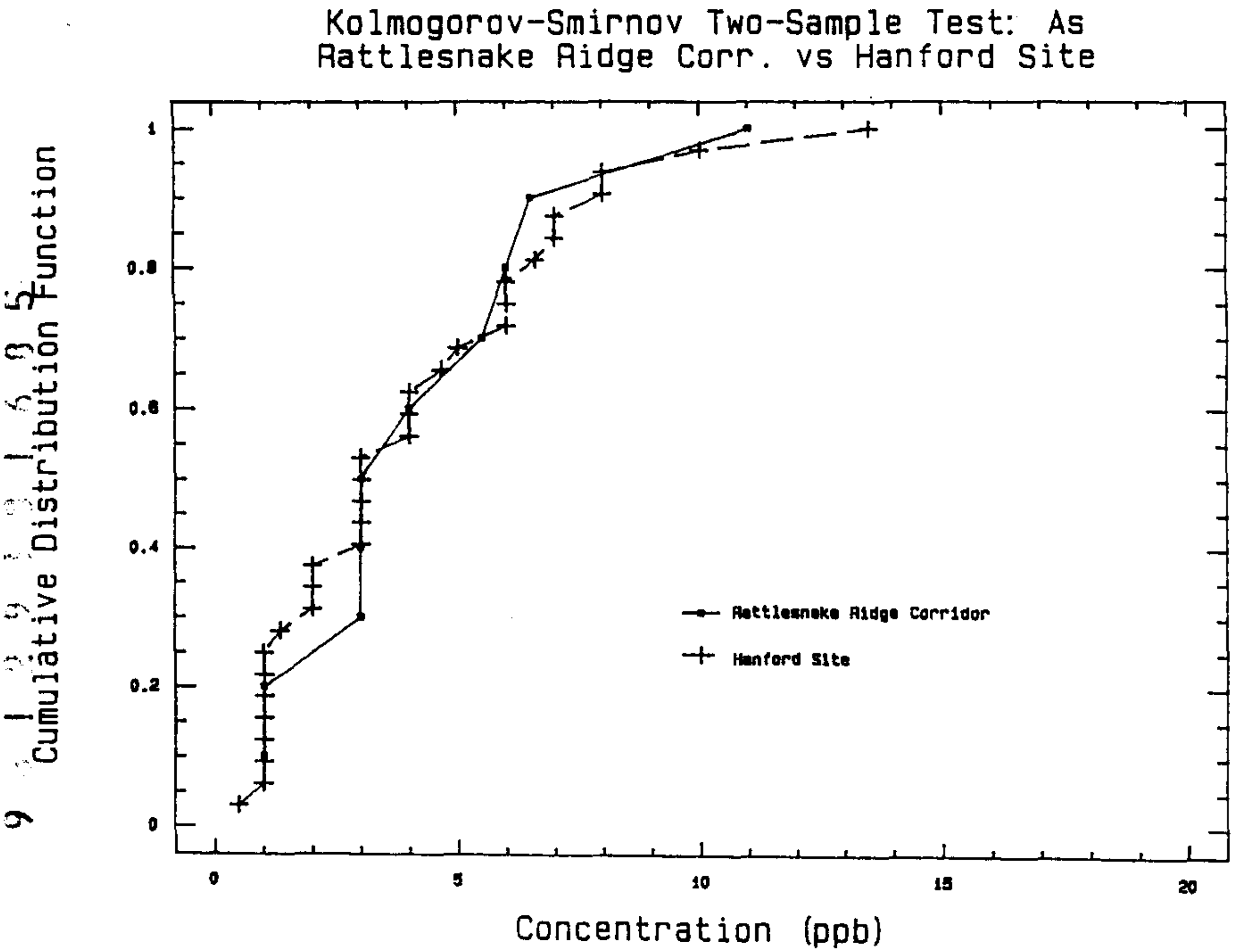
GEOSCI\M021793-A

WELL LOCATIONS AND PROPOSED "UPGRADIENT" BACKGROUND AREA (RATTLESNAKE RIDGE CORRIDOR)



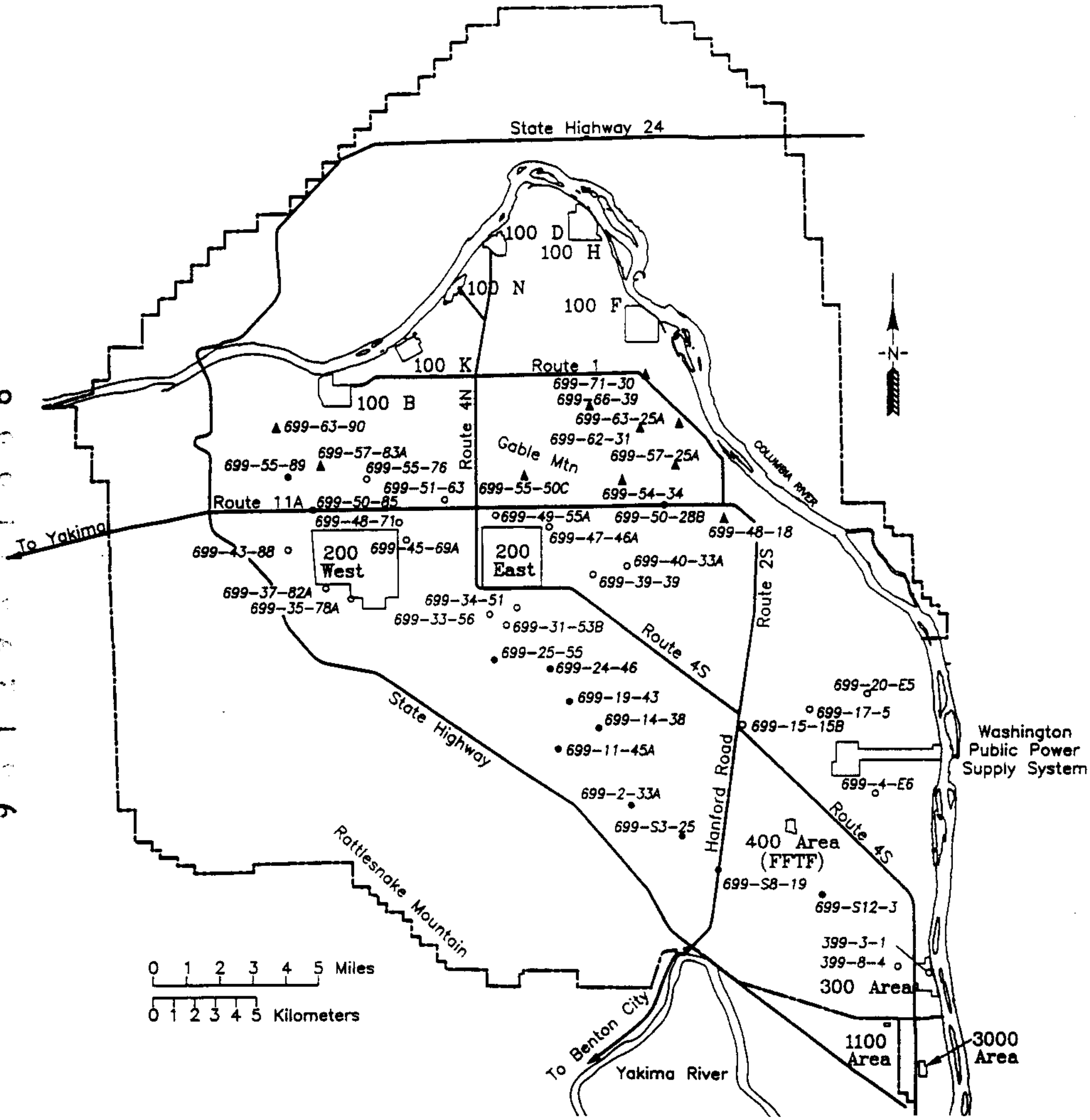
9 1 1 2 9 1 6 3 4

Comparison of an Upgradient (Rattlesnake Ridge Corridor) Population of Arsenic Concentrations with a Site-Wide Population Outside of Known Contamination



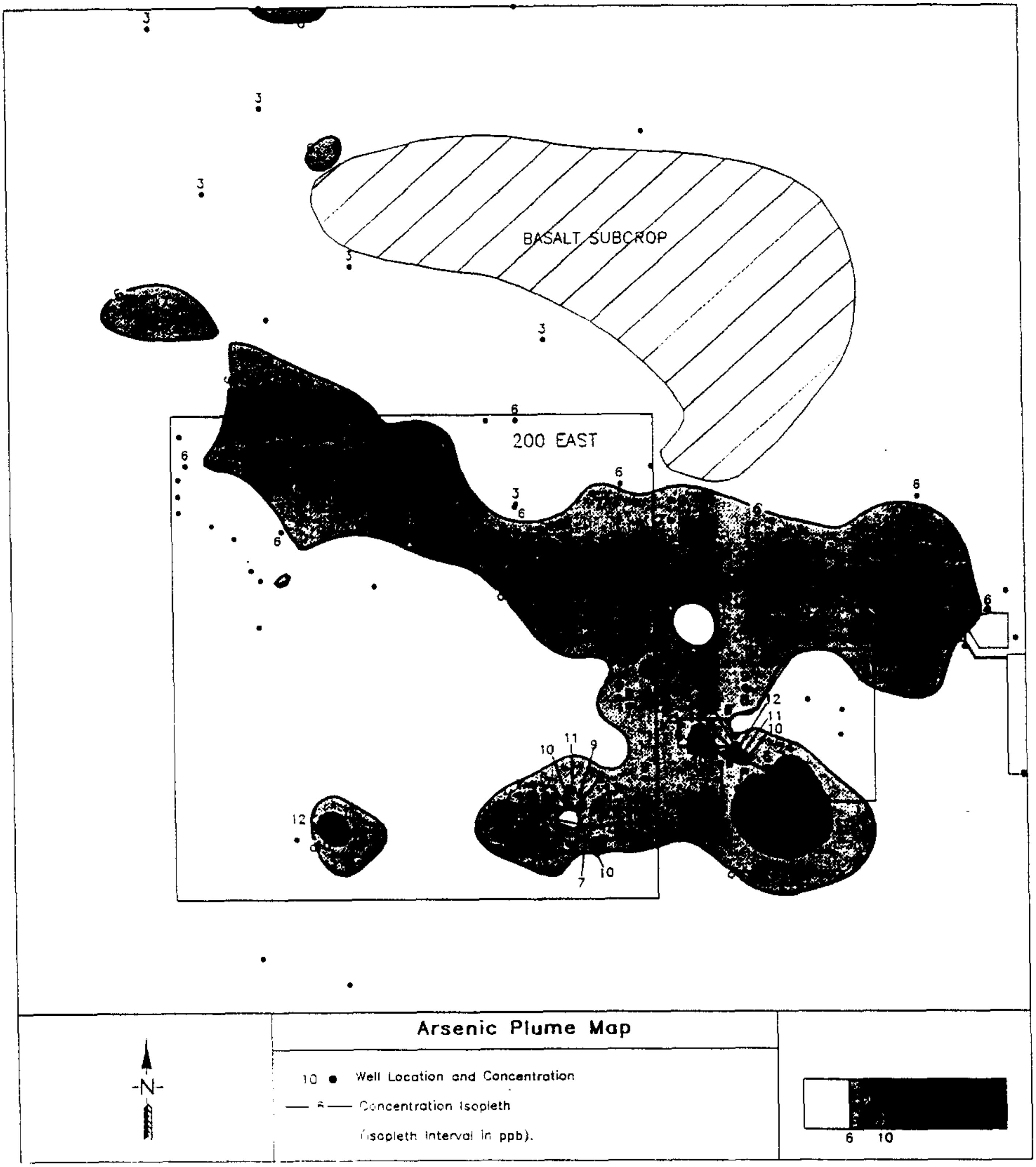
9 1 3 9 1 6 9 5

MONITORING WELL LOCATIONS OUTSIDE OF KNOWN CONTAMINANT PLUME AREAS USED FOR BACKGROUND APPLICATION TEST, USGS DATA, 1979-1984



Solid circles: Rattlesnake Ridge Corridor subset; solid triangles: Gable Mnt.-North subset; open circles: other area-wide locations. Tritium concentration was < 1000 pCi/L for all locations shown).

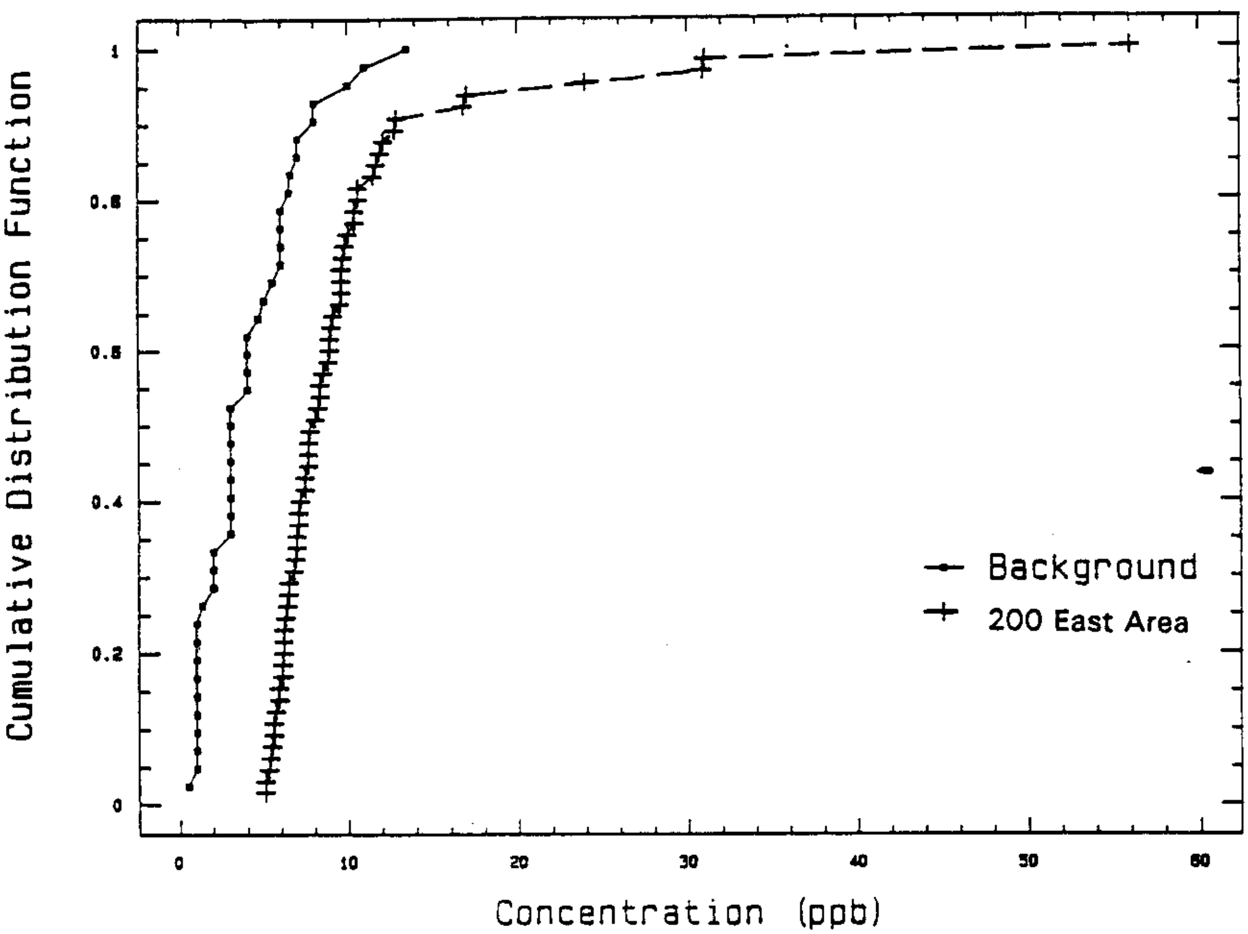
ARSENIC/GROUNDWATER PLUMES IN THE VICINITY OF 200 EAST AREA LIQUID WASTE DISPOSAL SITES



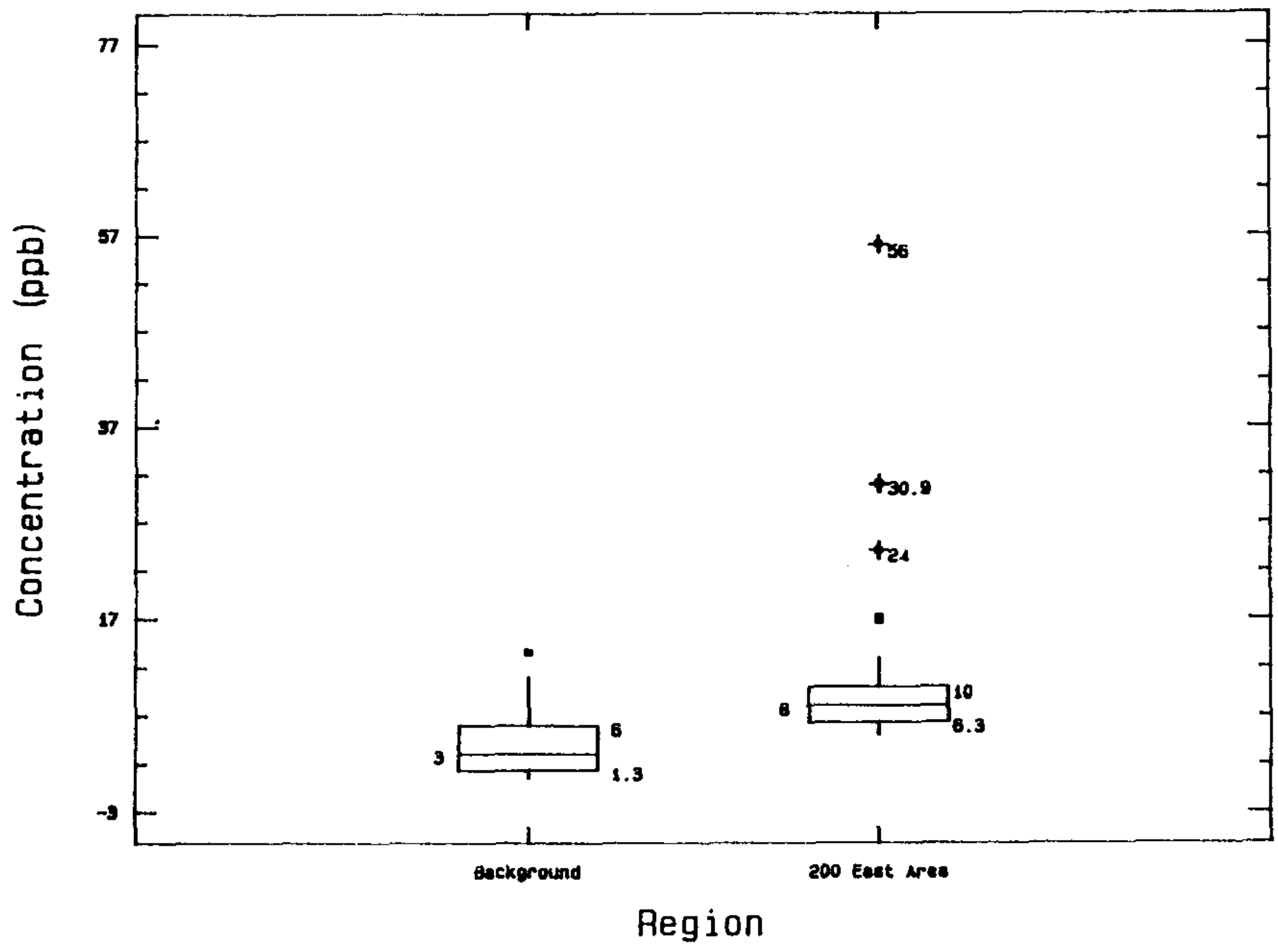
9 1 2 9 1 5 1 6 3 7

TEST CASE: ARSENIC IN 200 EAST AREA GROUNDWATER

Kolmogorov-Smirnov Two-Sample Test for Arsenic.



Multiple Box-and-Whisker Plot



SUMMARY AND CONCLUSIONS:

Interim Use of Existing Background Data

- Select appropriate background data set for constituent(s) of concern
- Use existing provisional background values for screening purposes only
- Use statistical hypothesis tests for background versus test data comparisons
- Use geochemical and hydrologic considerations ("conceptual model") in decision-making process

SUMMARY AND CONCLUSIONS , CONTINUED

Potential Concerns with Application of Ecology Guidance at Hanford

- Hypothesis to be tested should be:
  Null Hypothesis: site is "clean" and
  Alternative Hypothesis: site is "not clean"

- Background should not be considered as a constant without error

- May result in unnecessary groundwater remediation

- Spatial variability not considered

SUMMARY AND CONCLUSIONS, CONTINUED

Suggestions:

- Phased approach for acquisition of new background data
- Develop alternative site-specific guidance for Hanford (currently in progress)

APPENDIX

NOTE:

- The statistical methods and interpretations presented in this appendix should not be construed as a WHC or DOE position. They should be regarded only as suggested preliminary approaches for evaluation of groundwater data.

- Consultation with WHC Regulatory and Permitting Functions is advised for the most current interpretation of state and federal regulations in those cases where exceedances are encountered.

APPENDIX A-2: STATISTICAL METHODS

The primary purposes of Appendix A-2 are: (1) to demonstrate the use of Ecology's statistical guidance document (Ecology 1992) to calculate background threshold values; (2) to illustrate problems that might be encountered in applying the statistical methods recommended by Ecology for evaluating groundwater background data; and (3) to illustrate an approach suitable for analyzing groundwater data at the Hanford Site. In addition, methods discussed in this Appendix represent initial efforts to establish statistical guidance for evaluation of groundwater at the Hanford Site.

Natural background data and related statistical tests at the Hanford Site may be used in the decision making process associater with: (1) detection, assessment, and/or corrective action at RCRA sites; (2) compliance testing for operational groundwater surveillance ; (3) groundwater impact assessments at active liquid waste disposal sites; and (4) cleanup considerations at Comprehensive Environmental Response Compensation and Liability Act (CERCLA) sites. These major areas are discussed separately in the following sections.

A-2.1 RCRA Monitoring

Interim Status--RCRA groundwater monitoring networks are designed to detect the possible impact of a specific facility on groundwater quality. A "local area" background is used to account for contaminant sources upgradient from RCRA facilities. The sampling and statistical difference testing of the upgradient (background) vs downgradient (compliance) means are prescriptive in these cases (i.e., the averaged replicate t-test on means between individual downgradient wells and local background). However, the natural background can/should be used to test the "robustness" of critical mean exceedances in some cases. For example, if the local area background critical mean for an indicator parameter is exceeded in a single downgradient well (after verification sampling), but not for the natural background, the decision to initiate assessment monitoring should be reconsidered or an alternative course of action negotiated. In addition, in may be necessary in some cases to substitute the natural background values for data from local upgradient wells (e.g., due to interference with upgradient wells from nearby contaminant sources or dilution of the upgradient groundwater by cooling water discharges).

Final Status--RCRA groundwater monitoring programs under final status allow more latitude in application of statistical methods to assess impact on groundwater quality (Figure A-2-1). If or when final status is assigned to the Hanford Site, background threshold (or tolerance limits) can be used (EPA 1989) to assess the likelihood that background has been exceeded beneath a treatment, storage, or disposal facility. Use of both local area and "natural" background values could presumably be applied in such testing. Various statistical tests, for a final status groundwater monitoring program, to detect the presence of trends, the shift in central tendency, and compliance with regulatory requirements are given in *RCRA Data Analysis Protocol for the Hanford Site, Washington* (WHC 1992).

A-2.2 Non-RCRA Monitoring

Comparison of natural background concentrations with observations in the vicinity of some waste disposal sites may be necessary in those cases where a RCRA monitoring network is not yet in place (i.e., there are no local upgradient wells). A comparison between upgradient-downgradient wells at these sites can be treated in the same manner as a RCRA site under final status (Figure A-2-1) but using the natural background data in place of local area or upgradient wells.

To illustrate various statistical methods to test the hypothesis whether concentrations of a specific analyte of concern at a waste site is significantly different than natural background concentrations, a test case is provided. The analyte of concern is arsenic (200 East Area [DOE/RL 1992]). Note that the background data set and the test site data used in this Appendix are for the purpose of illustration only. Therefore, the background values derived for the test case may not necessarily be representative of Hanford Sitewide groundwater background.

Test Case

The background data set for this test consists of arsenic concentrations from a total of 42 wells: 10 wells in the Rattlesnake Ridge Corridor and another 32 wells across the Hanford Site that lie outside of known contaminant plumes. The primary criteria used in selection of test data suitable for consideration in the evaluation of natural background include site geohydrology, well characteristics, and the distribution of indicator contaminants in the groundwater (i.e., tritium less than 1,000 pCi/l). The data base consists of U.S. Geological Survey results from various wells sampled at the Hanford Site during 1977 through 1984.

The compliance data set for the test case consists of arsenic levels from 65 wells in the 200 East Area (DOE/RL 1992). Raw data from the background area described above and the 200 East area are presented in Table A-2-1 and Table A-2-2, respectively. There is only one non-detect arsenic value from the background area. Based on Ecology guidance the non-detect was replaced by 1/2 of the detection limit (i.e., 1 ppb). The results of the analysis are generally not sensitive to the specific choice of the replacement value if the number of nondetects is few. Gross beta values from the background area are also presented for the purpose of illustrating Ecology's default procedure for the determination of cleanup standards based on background data (see discussion in A-2.3). Unless otherwise specified, the statistical software package STATGRAPHICS Version 4.2 (a trademark of Statistical Graphics Corporation) was used to generate the plots and test statistics.

Figure A2-1. Background Well to Compliance Well Comparisons.

Source: EPA (1989, page 5-3)

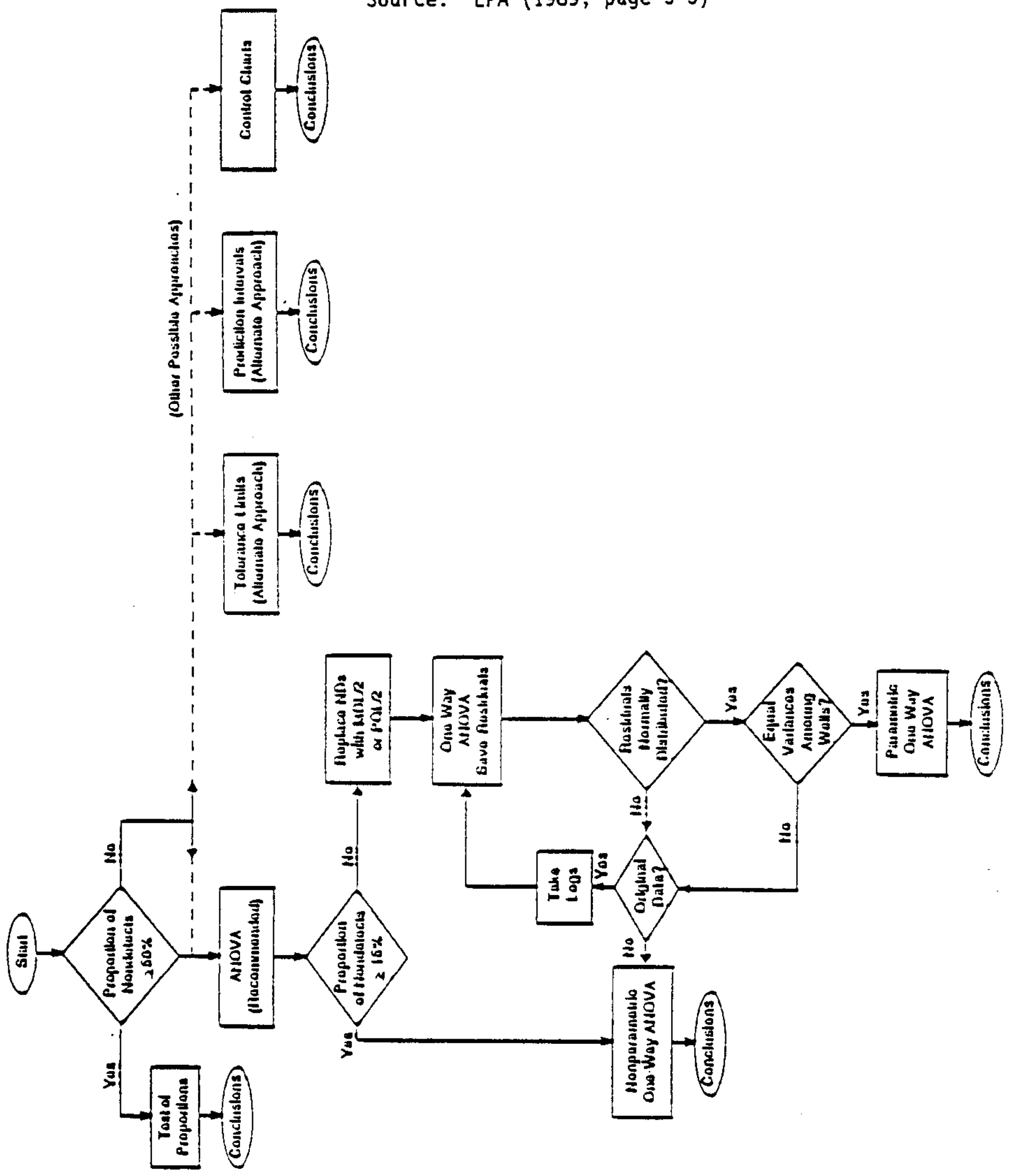


Table A-2-1. Background Arsenic and Gross Beta Data From 42 Wells Across the Hanford Site. (sheet 1 of 2)

Well Number	Well Name	Arsenic (ppb)	Gross Beta (pCi/l)	Arsenic (ln ppb)	Gross Beta (ln pCi/l)
1	6-S12-3	5.5	6.5	1.7047	1.8641
2	6-S8-19	11.0	7.9	2.3979	2.0605
3	6-S3-25	6.0	7.1	1.7918	1.9601
4	6-2-33	6.5	4.7	1.8718	1.5369
5	6-11-45A	3.0	4.2	1.0986	1.4351
6	6-14-38	4.0	4.1	1.3863	1.3987
7	6-19-43	3.0	8.2	1.0986	2.0980
8	6-24-46	1.0	5.1	0.0000	1.6292
9	6-25-55	3.0	4.9	1.0986	1.5892
10	6-55-89	1.0	4.5	0.0000	1.5041
11	6-20-E5-0	5.0	7.3	1.6094	1.9879
12	6-33-56	4.7	6.6	1.5404	1.8820
13	6-35-78	3.0	18.0	1.0986	2.8904
14	6-4-86	7.0	7.5	1.9459	2.0149
15	6-49-55	6.6	9.8	1.8871	2.2865
16	6-48-71	1.0	3.2	0.0000	1.1632
17	6-63-90	3.0	3.8	1.0986	1.3350
18	6-50-28B	7.0	3.9	1.9459	1.3610
19	6-34-51	6.0	5.1	1.7918	1.6292
20	6-55-76	1.3	4.7	0.2877	1.5476
21	6-31-53B	6.0	4.9	1.7918	1.5892
22	6-45-69	4.0	2.6	1.3863	0.9555
23	6-71-30	6.0	7.0	1.7918	1.9459
24	6-51-63	4.0	3.6	1.3863	1.2809
25	6-57-25A	13.5	6.2	2.6027	1.8165
26	6-37-82A	2.0	7.8	0.6931	2.0541
27	6-43-88	0.5	3.7	-0.6931	1.3083
28	6-48-18	1.0	6.3	0.0000	1.8405

Table A-2-1. Background Arsenic and Gross Beta Data From 42 Wells Across the Hanford Site. (sheet 2 of 2)

Well Number	Well Name	Arsenic (ppb)	Gross Beta (pCi/l)	Arsenic (ln ppb)	Gross Beta (ln pCi/l)
29	6-50-85	2.0	3.8	0.6931	1.3350
30	6-55-50C	3.0	4.1	1.0986	1.3987
31	6-57-83	1.0	2.8	0.0000	1.0296
32	6-62-31	1.0	4.9	0.0000	1.5892
33	6-63-25A	4.0	4.1	1.3863	1.4110
34	6-66-39	1.0	2.5	0.0000	0.9163
35	3-8-4	8.0	4.6	2.0794	1.5261
36	6-15-15B	8.0	9.8	2.0794	2.2824
37	6-17-5	3.0	5.7	1.0986	1.7405
38	3-3-1	1.0	11.0	0.0000	2.3979
39	6-40-33	10.0	5.5	2.3026	1.7047
40	6-39-39	2.0	5.3	0.6931	1.6677
41	6-47-46	3.0	8.1	1.0986	2.0919
42	6-54-34	1.0	4.6	0.0000	1.5261
Mean ($\overline{x}$)		4.1333	N.C.	1.1224	1.6805
Standard Deviation (s)		3.0346	N.C.	0.8302	0.4040
Variance(s^2)		9.2088	N.C.	0.6892	0.1632
Denominator[a] = $(n-1)*s^2$		377.57	N.C.	28.26	6.69

[a]Denominator for the W statistic.
N.C. = not calculated.

Table A-2-2. Arsenic Data From the 200 East Area.
(sheet 1 of 2)

Well Number	Arsenic (ppb)	Arsenic (ln ppb)	Well Number	Arsenic (ppb)	Arsenic (ln ppb)
1	6.4	1.8563	21	11.9	2.4765
2	5.5	1.7047	22	6.1	1.8083
3	7.1	1.9601	23	7.6	2.0281
4	6.1	1.8083	24	10.4	2.3418
5	7.4	2.0015	25	7.6	2.0281
6	9.6	2.2618	26	6.1	1.8083
7	8.9	2.1861	27	5.0	1.6094
8	8.0	2.0794	28	5.0	1.6094
9	5.8	1.7579	29	9.0	2.1972
10	9.1	2.2083	30	11.7	2.4596
11	8.2	2.1041	31	10.6	2.3609
12	8.3	2.1163	32	5.8	1.7579
13	6.9	1.9315	33	30.9	3.4308
14	5.3	1.6677	34	17.0	2.8332
15	5.5	1.7047	35	24.0	3.1781
16	6.8	1.9169	36	12.8	2.5494
17	6.0	1.7918	37	8.9	2.1861
18	6.9	1.9315	38	31.0	3.4340
19	5.2	1.6487	39	7.6	2.0281
20	12.9	2.5572	40	8.3	2.1163

Table A-2-2. Arsenic Data From the 200 East Area.
(sheet 2 of 2)

Well Number	Arsenic (ppb)	Arsenic (ln ppb)	Well Number	Arsenic (ppb)	Arsenic (ln ppb)
41	10.6	2.3609	54	6.3	1.8405
42	5.4	1.6864	55	7.0	1.9459
43	9.6	2.2618	56	9.5	2.2513
44	56.0	4.0254	57	6.2	1.8245
45	8.5	2.1401	58	9.7	2.2721
46	9.6	2.2618	59	6.4	1.8563
47	11.5	2.4423	60	8.8	2.1748
48	12.1	2.4932	61	5.6	1.7228
49	7.7	2.0412	62	6.7	1.9021
50	7.4	2.0015	63	10.4	2.3418
51	7.0	1.9459	64	6.0	1.7918
52	10.0	2.3026	65	16.8	2.8214
53	9.8	2.2824			

Source: DOE/RL (1992).

Kolmogorov-Smirnov two-sample test. The test method presented here is called the Kolmogorov-Smirnov two-sample test. It is useful in situations where two samples are drawn, one from each of two possibly different populations, and to determine whether the two distribution functions associated with the two populations (background and the site) are identical or not. The Kolmogorov-Smirnov two-sample test is preferred over other tests such as the median test, the Mann-Whitney test, or the parametric t-test because these tests are only sensitive to differences between the two means or medians. But, these tests are not sensitive to differences of other types, such as differences in variances. The Kolmolgorov-Smirnov two-sample test is sensitive against all types of differences that may exist between the two distribution functions (Conover 1980).

Assumptions. The data consist of two independent random samples, one of size n, X_1, X_2, ..., X_n from the background area (n = 42), and the other of size m, Y_1, Y_2, ..., Y_m from the waste management area (m = 65). Let F(x) and G(x) represent their respective, unknown, distribution functions.

Hypothesis. The null hypothesis, H_o, is that the two distribution functions are the same for all x values. The alternative hypothesis, H_a, is stated as the Xs (i.e., the background data) tend to be smaller than the Ys (i.e., the data from the 200 East Aggregate Area). The hypothesis can also be stated as:

H_o: F(x) = G(x), for all values of x from $-\infty$ to $+\infty$
H_a: F(x) > G(x), for at least one value of x

Test Statistic. Let $S_1(x)$ be the empirical distribution function based on the background arsenic values, X_1, X_2, ..., X_{42}, and let $S_2(x)$ be the empirical distribution function based on the arsenic values from the 200 East Aggregate Area, Y_1, Y_2, ..., Y_{65}. The test statistic T_1^+ is defined as the greatest (denoted by "sup" for supremum) vertical distance where the function $S_1(x)$ is above the function $S_2(x)$. Or, stated in mathematical term:

$$T_1^+ = \sup\,[S_1(x) - S_2(x)]$$

which is read as "T_1^+ equals the supremum, over all x, where the function $S_1(x)$ is above the function $S_2(x)$."

Decision Rule. Reject H_o at the level of significance α = 0.05 if the test statistic T_1^+ exceeds the 1 - α (0.95) quantile as given in Table A21 of Conover (1980). For values of n and m not covered by the table, the large sample approximations provided at the end of the table may be used. For example, in the arsenic case, n = 42 and m = 65, at the 5% level of significance, the critical value equals $1.22*\sqrt{(m+n)/mn}$ = 0.242.

Example 1 - Comparison of Background and Contaminated Zone Arsenic Levels. The test statistic T_1^+ is calculated to be 0.667 which is greater than the 0.95 quantile (i.e., the critical value) = 0.242. Hence the null hypothesis is rejected at 5% level of significance. The alternative hypothesis that the background arsenic values tend to be smaller than that from the 200 East Area is accepted. The Kolmogorov-Smirnov two-sample test result is also presented in Figure A-2-2. It is obvious from Figure A-2-2 that background arsenic values are smaller. A multiple box-and-whisker plot of the arsenic levels is shown in Figure A-2-3. This plot shows that only four or five values are outside the range of natural variation in arsenic values at the Hanford Site. Thus the size of the area of significant impact is much smaller than the area represented by the compliance data set. Cleanup related considerations for this case are discussed in the following section.

A-2.3 COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION LIABILITY ACT/ MODEL TOXICS CONTROL ACT CLEANUP STANDARDS

The cleanup standard should be determined for the contaminants present at the site. This standard may be based on appropriate applicable state and federal laws, risk, ecological factors, and analytical considerations (e.g., below detection limit data, practical quantitation limit), or may be related to background levels of the contaminant at the site. Under MTCA, there are three basic methods for establishing cleanup levels in groundwater (WAC 173-340-700). Cleanup levels resulting from these methods are briefly defined as:

- Method A-- numerical standards (routine cleanup method) for 25 of the most common hazardous substance found at the sites. This method is designed for cleanup cases that are relatively straight forward or involve only a few hazardous substance, all of which must be listed in the Method A tables (see page 77 of MTCA). This approach will be used mainly by small sites that do not warrant the costs of conducting risk assessments and site studies.

- Method B-- site-specific method that includes risk-assessment-based standards, standards based on applicable state and federal laws, or natural background concentrations (standard method). The risk level for individual carcinogens cannot exceed 1 in 1,000,000. If more that one type of hazardous substance is present, the total risk level at the site may not exceed 1 in 100,000.

- Method C-- This method is similar to method B except that the lifetime cancer risk is set at 1 in 100,000 for both individual substances and for the total risk caused by all substances on a site. This method is used when compliance with Method A or B cleanup levels is impossible or may cause greater environmental harm or if the site is an industrial site (conditional method).

Natural vs. Area Background Concentrations. The MTCA regulations make a distinction between natural and area background concentrations as described below:

- Natural background refers to the concentration of a constituent that occurs naturally in the environment and has not been influenced by localized human activities (WAC 173-340-200).

Figure A-2-2. Kolmogorov-Smirnov Two-Sample Test for Arsenic.

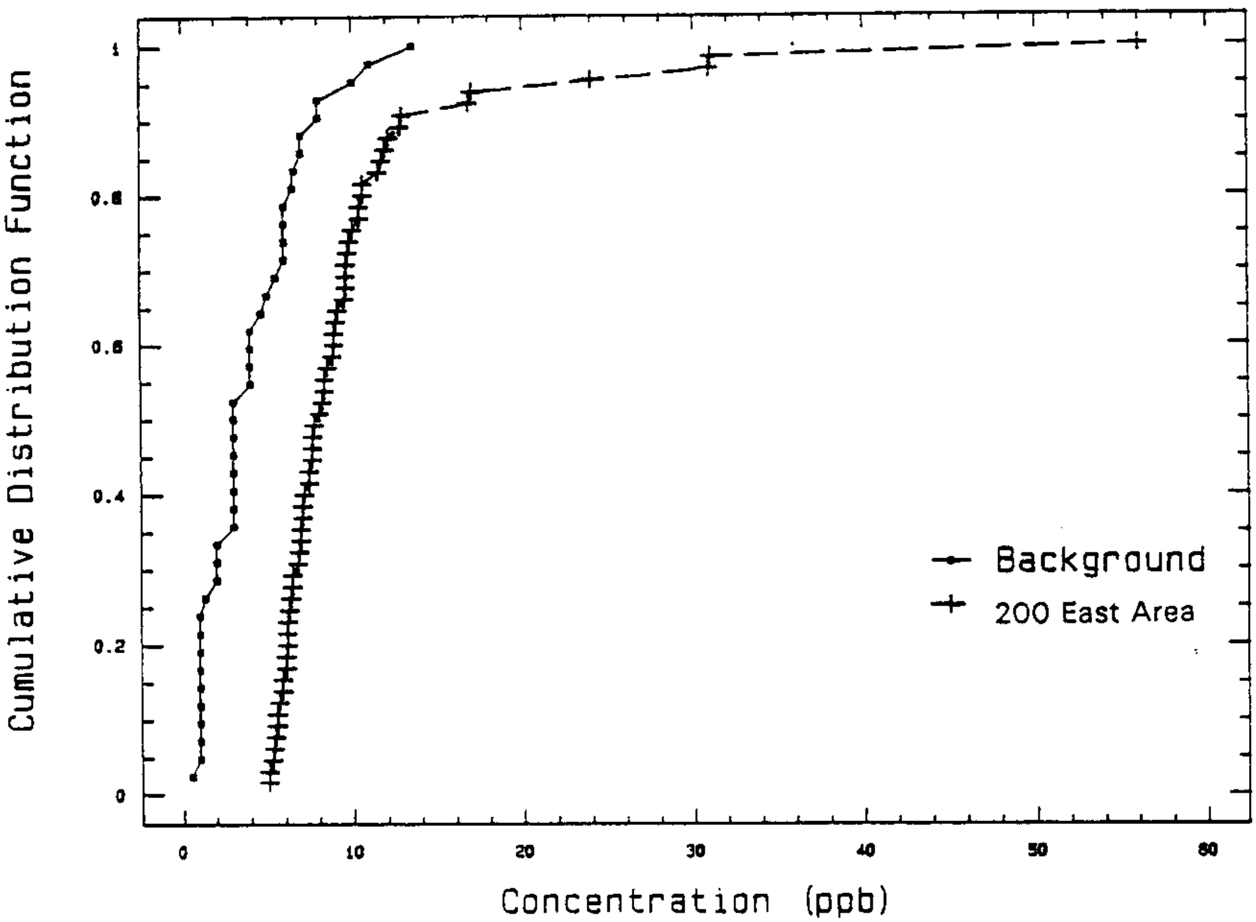
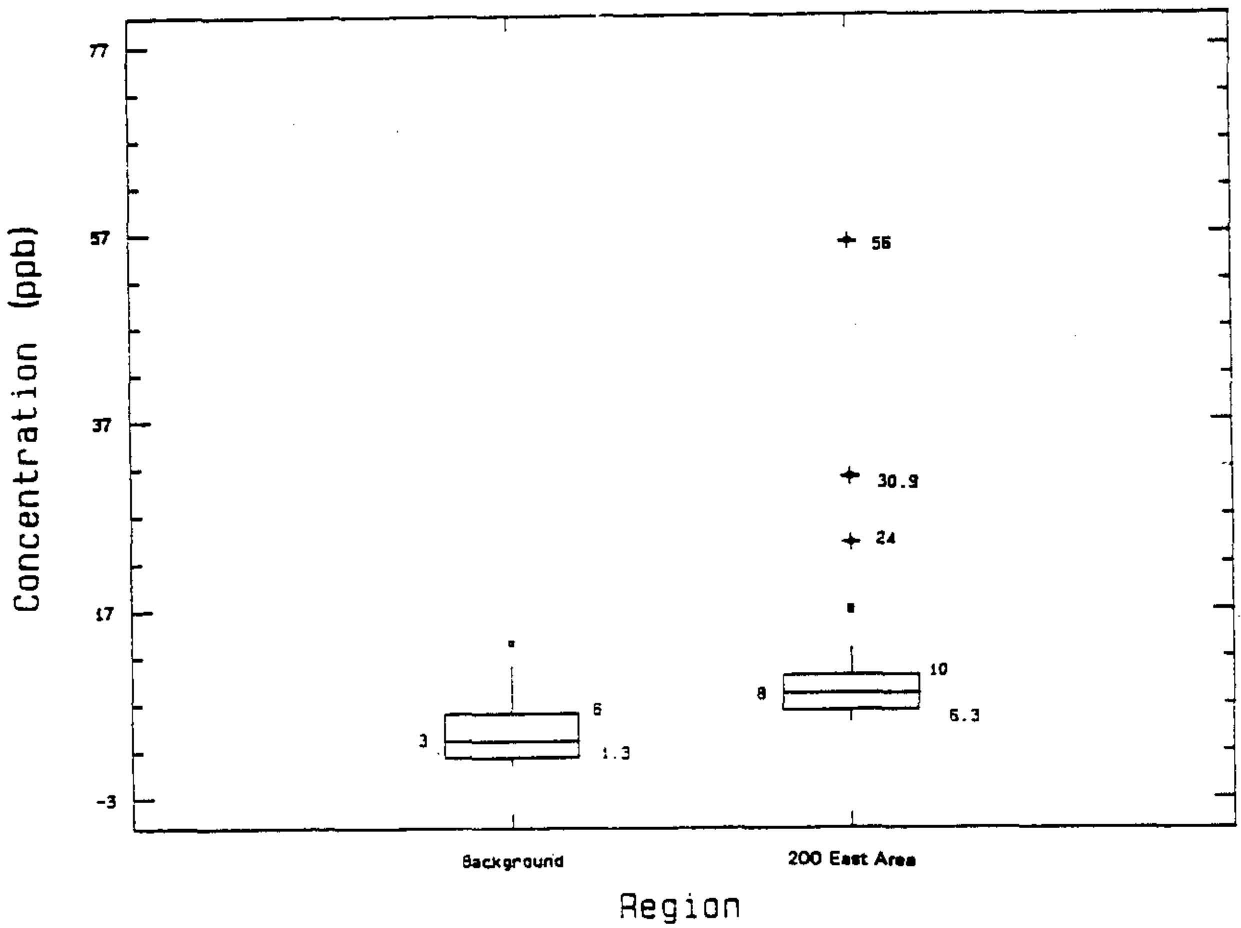


Figure A-2-3. Multiple Box-and-Whisker Plot for Arsenic.



9 3 1 2 9 1 7 0 5

- Area background is defined as the concentration of hazardous substances that are consistently present in the environment in the vicinity of a site which are the result of human activities unrelated to releases from that site (WAC 173-340-200).

Use of Background in the Cleanup Standards Regulation. Background data can generally be used in three ways to establish cleanup standards:

- Natural background can be used to establish a cleanup standard for a hazardous substance for which no applicable or relevant and appropriate requirement (ARAR) or cleanup standard regulation value exists [WAC 173-340-704(2)(c)].

- Natural background can be used to replace an existing Method A, Method B, or Method C cleanup standard when that standard is below the natural background level [WAC 173-340-700(4)(d)].

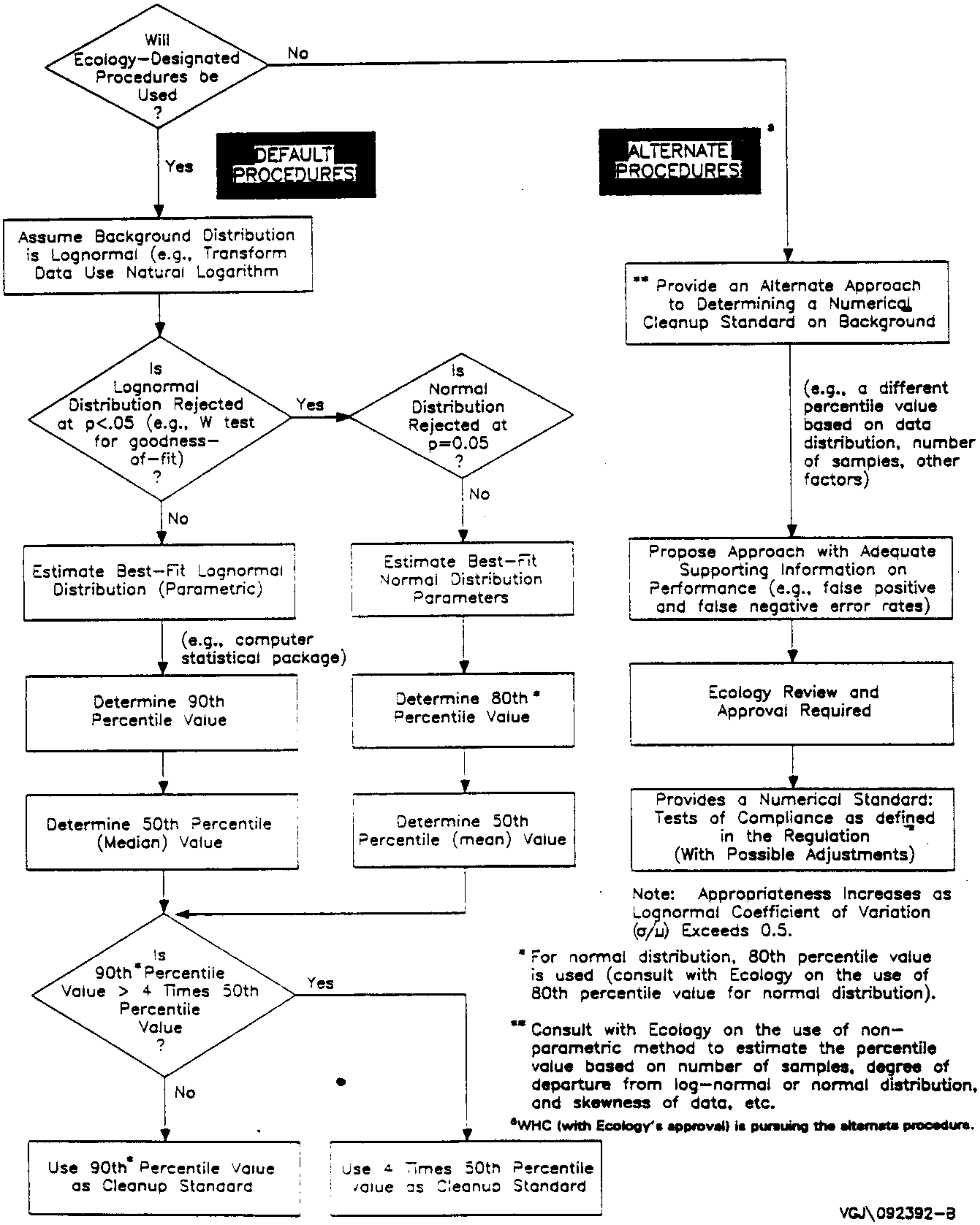
- When Method A or Method B cleanup standards are below area background levels, Method C can be used to establish the cleanup standard. When Method C cleanup standard is below area background, the cleanup standard may be set equal to the area background value subject to constraints on maximum allowable Method C cleanup levels [WAC 173-340-706(1)(a)].

Determination of Background Values Based on Ecology's Statistical Guidance Document (Ecology 1992). A flowchart to provide an overview of the data evaluation procedures for determining possible cleanup standards based on background under MTCA is shown in Figure A-2-4. This flowchart is a slight modification of Figure 12 shown in the statistical guidance document of Ecology (1992). The default procedure is to calculate the 90th percentile value based on a log-normal distribution as the default background value for cleanup standard and site evaluations, provided that: (1) the background data are log-normally distributed (e.g., based on the Wilk-Shapiro W-test for normality) and (2) the 90th percentile value is less than 4 times the median value (the 50th percentile). If background data are log-normally distributed, but the 90th percentile value exceeds 4 times the median value, the background value is determined to be 4 times the median value.

Ecology's default procedure establishing the background-based cleanup standard at the 90th percentile of the estimated distribution is based on the assumption of a log-normal distribution. In cases where the assumption of a lognormal distribution is rejected, Ecology should be consulted on appropriate alternative procedures to establish the cleanup standard. For a normal distribution, assume concurrence from Ecology, the cleanup standard should be the lesser of (1) the estimated 80th percentile and (2) 4 times the mean value of the estimated normal distribution. Note that Ecology may determine that another percentile is more appropriate on a site-specific basis.

Based on Ecology's statistical guidance document if background data sets are neither log-normally nor normally distributed, a nonparametric method (requires consultation with Ecology), which does not require the data to fit any particular distribution type, should be used. However, Ecology has to be consulted with regarding which percentile (90th or 80th or something else) to

Figure A-2-4. Flowchart for Determination of Cleanup Standards Based on Background Data Modified After Ecology (1992).



use. Additionally, Ecology recognizes the fact that using the standard default methods will pose problems for simultaneously achieving desirable false positive error rates and statistical power to detect residual contamination when background data are highly skewed and background samples are relatively small. In such cases, it may be appropriate to consider using alternative distribution test methods such as the Wilcoxon Rank Sum test and the Quantile tests (see further discussions in A2.4).

In Example 2, the gross beta data from 42 wells of the background area (see Table A-2-1) is used to illustrate the default procedure for calculating cleanup standard based on natural background. In Example 3, the arsenic values from the background area are used to illustrate alternative procedures for estimating the background-based cleanup standard (requires concurrence of Ecology). The test procedure for the Wilk-Shapiro W-test for normality of data was given below because the result of the goodness-of-fit test will determine which procedure to use.

The Wilk-Shapiro W-test. The Wilk-Shapiro W-test for normality of data is Ecology's recommended goodness-of-fit test procedure to examine the assumption of data distribution. The test procedures are described below.

Assumption. The data consist of a random sample X_1, X_2, ..., X_n of size n (n = 42) associated with some unknown distribution function F(x).

Hypothesis. The null hypothesis is that the data are drawn from a normal distribution function with unspecified mean and variance. The alternative hypothesis is that the data are not normal.

H_o: F(x) is a normal distribution with unspecified mean and variance.
H_a: F(x) is non-normal.

Test Statistic. First calculate the denominator D of the test statistic

$$D = \sum(X_i - \bar{x})^2,$$

where $\bar{x}$ is the sample mean and the summation (denoted by $\sum$) is from i=1 through i=n. Then order the sample from the smallest to the largest, $X_{(1)} \leq X_{(2)} \leq \ldots \leq X_{(n)}$ where $X_{(i)}$ denotes the ith order statistic. Then define k = n/2, if n is even and k = (n-1)/2 if n is odd. For the observed sample size n, obtain coefficients a_1, a_2, ... a_k from Table A17 of Conover (1980). The test statistic is given by

$$W = (1/D) * [\sum a_i(X_{(n-i+1)} - X_{(i)})]^2$$

where the summation (denoted by $\sum$) is from i=1 through i=k.

Decision Rule. Reject H_o at the α=0.05 level of significance if W is less than the α quantile given by Table A18 of Conover (1980). Note that Table A18 allows the Wilk-Shapiro test to be used only if n≤50. For n larger than 50, one may use an extension of this procedure using coefficients given in Table A-8 of Shapiro (1980) or use D'Agostino test (see Gilbert 1987, pages 160-162).

Example 2 - Ecology's Default Procedure to Calculate Gross Beta Background Value. In this example, gross beta activity levels (pCi/l) from the 42 wells in the background area was used to illustrate Ecology's default log-normal assumption to calculate a background-based standard. The background data (Xs) was first transformed into Ys (i.e., Y = ln X) using natural logarithm (see Table A-2-1, last column). Then, Wilk-Shapiro's W-test procedure was applied to the log-transformed values. The denominator, D, of the W-test test statistic is calculated to be 6.6921. The numerator is 6.5232. Hence the test statistic W is 6.6532/6.6921 = 0.9748. The critical value is 0.942 (from Table A18 of Conover 1980) for a sample size of 42 at 5% level of significance (α=0.05). The null hypothesis that the gross beta data from the background area follow a log-normal distribution cannot be rejected at the 5% level because the calculated value of W (=0.9748) is greater than the critical value (i.e., 0.942). The W-test result for the gross beta is shown in Table A-2-3.

Refer to Figure A-2-4, for a log-normal distribution, the background value is determined to be the 90th percentile, if it is lower than 4 times the median value. The following formula is used to estimate the pth percentile of a log-normal distribution:

$$Y_p = \bar{y} + Z^{p}*s$$

Where $\bar{y}$ and s are the mean and standard deviation of the log-transformed data, respectively and Z_p is the pth quantile of a standard normal distribution. For example, for a 90th percentile, Z_{90}=1.282 and for a 50th percentile (median), the corresponding Z_p value is 0.

Substituting $\bar{y}$=1.6805, s=0.4040, and Z_{90}=1.282 into above equation, Y_{90} = 1.6805 + 1.282*0.4040 = 2.1984 (in unit of ln pCi/l). Hence, the 90th percentile is estimated to be $X_{90}=e^{2.1984}$=9.01 (pCi/l).

Similarly, Y_{50}=1.6805 (ln pCi/l) and the 50th percentile (original scale) is estimated to be $X_{50}=e^{1.6805}$=5.3682 (pCi/l). The use of the estimated 90th percentile as background value is subject to the constraint that the 90th percentile is smaller than 4 times the median value (see Figure A-2-4).

For gross beta, X_{90}=9.01 < 4*5.3682=21.473 (pCi/l). The background value is calculated to be 9.01 pCi/l.

Table A-2-3. The Wilk-Shapiro W-Test Result Using log Gross Beta Data From the Background Area.

Rank[a] (i)	Coefficient a_i[b]	$Y_{(i)}$[c]	$Y_{(n-i+1)}$[c]	Difference[d]	a_i*Diff[e]
1	0.3917	0.9163	2.8904	1.9741	0.7732
2	0.2701	0.9555	2.3979	1.4424	0.3896
3	0.2345	1.0296	2.2865	1.2568	0.2947
4	0.2085	1.1632	2.2824	1.1192	0.2334
5	0.1874	1.2809	2.0980	0.8171	0.1531
6	0.1694	1.3083	2.0919	0.7835	0.1327
7	0.1535	1.3350	2.0605	0.7255	0.1114
8	0.1392	1.3350	2.0541	0.7191	0.1001
9	0.1259	1.3610	2.0149	0.6539	0.0823
10	0.1136	1.3987	1.9879	0.5892	0.0669
11	0.1020	1.3987	1.9601	0.5614	0.0573
12	0.0909	1.4110	1.9459	0.5349	0.0486
13	0.0804	1.4351	1.8820	0.4469	0.0359
14	0.0701	1.5041	1.8641	0.3600	0.0252
15	0.0602	1.5261	1.8405	0.3145	0.0189
16	0.0506	1.5261	1.8165	0.2904	0.0147
17	0.0411	1.5369	1.7405	0.2036	0.0084
18	0.0318	1.5476	1.7047	0.1572	0.0050
19	0.0227	1.5892	1.6677	0.0785	0.0018
20	0.0136	1.5892	1.6292	0.0400	0.0005
21	0.0045	1.5892	1.6292	0.0400	0.0002
				Sum =	2.5541
				Sum^2 =	6.5232
				Denominator[f] =	6.69
				W = (Sum^2/Denom.)	0.9748

[a]Rank of the data.
[b]Coefficients from Table A17 of Conover (1980).
[c]Ordered data, for i=1, $Y_{(1)}$ is the smallest datum, $Y_{(n-i+1)}$ is the largest data based on the natural logarithms
[d]For i=1, Difference = $Y_{(n-i+1)} - Y_{(i)} = Y_{(n)} - Y_{(1)}$.
[e]This column is the product of a_i and the difference column.
[f]See Table A-2-1.

9 1 1 7 1 0

In the above example, the WAC 173-200 standard (50 pCi/l) would be used because the background value is lower than the standard. The case where a water quality or groundwater protection standard is lower than the natural background is considered in Example 3.

Example 3 - Ecology's Alternative Procedure to Establish Arsenic Background Value. This example illustrates how to establish a background value under Ecology's alternative procedure (Ecology has to be consulted). The background data set consists of arsenic data from 42 wells across the Hanford Site (see Table A-2-1). The first step is to perform the Wilk-Shapiro's W-test on the log-transformed arsenic data. The test statistic $W=0.931$ which is smaller than the critical value of 0.942 (for $n=42$ and $\alpha=0.05$). The assumption of a lognormal distribution is rejected at $\alpha=0.05$. The W-test result is shown in Table A-2-4.

The next step (see Figure A-2-4) is perform the Wilk-Shapiro W-test on the original data (in unit of ppb). The test statistic $W=0.894$ which is smaller than the critical value of 0.942. The assumption of a normal distribution is also rejected at $\alpha=0.05$. The W-test result is presented in Table A-2-5.

If background data set are neither log-normally nor normally distributed, a nonparametric method (requires consultation with Ecology), which does not require the data to fit any particular distribution type, should be used (see Figure A-2-4). Example 3 illustrates the use of a non-parametric procedure to estimate a 90th percentile as background value. The use of the 90th percentile is selected based on the following supporting evidence:

- The degree of departure from a log-normal distribution is not great. This is demonstrated by the W-test test statistic (on the log-transformed data) of 0.931 which is very close to the critical value of 0.942. Using the default procedure, the arsenic background value is estimated to be 8.91 ppb.
- The coefficient of variation based on the best fit log-normal distribution is close to 1 (0.996) indicating that the background arsenic case is highly skewed.
- The number of background samples is relatively large (i.e., data from 42 wells).

Assume that Ecology agrees with the above rationale for the use of a 90th percentile, the following steps illustrate how to obtain a non-parametric estimate of the pth percentile:

1. Sort the data from the smallest to the largest, and rank them from 1 (the smallest) to n (the largest), where n is the total number of samples in a data set. Data points with the same value (i.e., ties) should be ordered consecutively, and each data point assigned its own rank.

Table A-2-4. The Wilk-Spapiro W-Test Result Using log Arsenic Data From the Background Area.

Rank[a] (i)	Coefficient a_i[b]	$Y_{(i)}$[c]	$Y_{(n-i+1)}$[c]	Difference[d]	a_i*Diff[e]
1	0.3917	-0.6931	2.6027	3.2958	1.2910
2	0.2701	0.0000	2.3979	2.3979	0.6477
3	0.2345	0.0000	2.3026	2.3026	0.5400
4	0.2085	0.0000	2.0794	2.0794	0.4336
5	0.1874	0.0000	2.0794	2.0794	0.3897
6	0.1694	0.0000	1.9459	1.9459	0.3296
7	0.1535	0.0000	1.9459	1.9459	0.2987
8	0.1392	0.0000	1.8871	1.8871	0.2627
9	0.1259	0.0000	1.8718	1.8718	0.2357
10	0.1136	0.0000	1.7918	1.7918	0.2035
11	0.1020	0.2877	1.7918	1.5041	0.1534
12	0.0909	0.6931	1.7918	1.0986	0.0999
13	0.0804	0.6931	1.7918	1.0986	0.0883
14	0.0701	0.6931	1.7047	1.0116	0.0709
15	0.0602	1.0986	1.6094	0.5108	0.0308
16	0.0506	1.0986	1.5404	0.4418	0.0224
17	0.0411	1.0986	1.3863	0.2877	0.0118
18	0.0318	1.0986	1.3863	0.2877	0.0091
19	0.0227	1.0986	1.3863	0.2877	0.0065
20	0.0136	1.0986	1.3863	0.2877	0.0039
21	0.0045	1.0986	1.0986	0.0000	0.0000
				Sum =	5.1291
				Sum^2 =	26.308
				Denominator[f] =	28.26
				W =	0.9311

[a]Rank of the data.
[b]Coefficients from Table A17 of Conover (1980).
[c]Ordered data, for i=1, $Y_{(1)}$ is the smallest datum, $Y_{(n-i+1)}$ is the largest data based on natural logarithms.
[d]For i=1, Difference = $Y_{(n-i+1)} - Y_{(i)} = Y_{(n)} - Y_{(1)}$.
[e]This column is the product of a_i and the difference column.
[f]See Table A-2-1.

Table A-2-5. The W-Test Result Using Arsenic (Original Scale) Data From the Background Area.

Rank[a] (i)	Coefficient a_i[b]	$X_{(i)}$[c]	$X_{(n-i+1)}$[c]	Difference[d]	a_i*Diff[e]
1	0.3917	0.5	13.5	13.0	5.0921
2	0.2701	1.0	11.0	10.0	2.7010
3	0.2345	1.0	10.0	9.0	2.1105
4	0.2085	1.0	8.0	7.0	1.4595
5	0.1874	1.0	8.0	7.0	1.3118
6	0.1694	1.0	7.0	6.0	1.0164
7	0.1535	1.0	7.0	6.0	0.9210
8	0.1392	1.0	6.6	5.6	0.7795
9	0.1259	1.0	6.5	5.5	0.6925
10	0.1136	1.0	6.0	5.0	0.5680
11	0.1020	1.3	6.0	4.7	0.4760
12	0.0909	2.0	6.0	4.0	0.3636
13	0.0804	2.0	6.0	4.0	0.3216
14	0.0701	2.0	5.5	3.5	0.2454
15	0.0602	3.0	5.0	2.0	0.1204
16	0.0506	3.0	4.7	1.7	0.0843
17	0.0411	3.0	4.0	1.0	0.0411
18	0.0318	3.0	4.0	1.0	0.0318
19	0.0227	3.0	4.0	1.0	0.0227
20	0.0136	3.0	4.0	1.0	0.0136
21	0.0045	3.0	3.0	0.0	0.0000
				Sum =	18.3728
				Sum^2 =	337.5581
				Denominator[f] =	377.57
				W = (Sum^2/Denom.)	0.8940

[a]Rank of the data.
[b]Coefficients from Table A17 of Conover (1980).
[c]Ordered data, for i=1, $X_{(1)}$ is the smallest datum, $X_{(n-i+1)}$ is the largest data based on original scale.
[d]For i=1, Difference = $X_{(n-i+1)} - X_{(i)} = X_{(n)} - X_{(1)}$.
[e]This column is the product of a_i and the difference column.
[f]See Table A-2-1.

2. Estimate v by

$$v = p^*(n+1)/100$$

where v is the rank of the pth percentile data.

3. If v is an integer, then the pth percentile is simply the vth ranked datum in the sorted data set. If v is not an integer, then the pth percentile must be obtained by linear interpolation between the two closet order statistics.

In the arsenic case, the data are sorted from the smallest to the largest based on the original measurement scale (ppb). Next, v is estimated to be 90*(42+1)/100 = 38.7. The 90th percentile is estimated by linear interpolation between the 38th and 39th datum point in the sorted data set. The 38th and 39th datum point both have arsenic value of 8 ppb. Hence the 38.7th datum point is also 8 ppb. Using this alternative procedure, the arsenic background value is estimated to be 8 ppb (assume Ecology's concurrence).

The Method A cleanup standard for arsenic in groundwater is 5 ug/l (or 5 ppb) [WAC 173-340-720(2)(a)(i)] and the risk-based groundwater protection standard for arsenic in groundwater is 0.05 ug/l (or 0.05 ppb) [WAC 173-200-040(2)(c)]. The estimated natural background level ranges from 8 ppb (based on non-parametric procedure) to 8.91 ppb (based on the default procedure), which is about 1.6 to 1.8 times higher than the Method A cleanup standard and about 160 to 180 times higher than the WAC 173-200 groundwater protection standard (risk-based standard or Method B cleanup standard). In this situations, natural background can be used to replace an existing Method A (i.e., 5 ppb) or Method B (i.e., 0.05 ppb) when that standard is below the natural background level [WAC 173-340-700(4)(d)].

Other Considerations. Background groundwater concentrations, as well as onsite concentrations, may vary substantially over time (seasonal variations or trends), over space (spatial variations), and/or may be serially correlated (autocorrelation). If temporal and spatial variations are present in the data, they must be carefully accounted for in the sampling design as well as in the statistical evaluation process. A model which considers seasonal pattern and autocorrelation structure in the data is provided in Environmental Protection Agency (EPA) document (EPA 1988).

A-2.4 COMPLIANCE MONITORING

In this section Ecology's requirement with regard to compliance with groundwater cleanup standards are described first. An evaluation of Ecology's methods to assess the attainment of cleanup standards is discussed next.

Comparing Site Data to Standards Using Ecology's Statistical Guidance Document (Ecology 1992). Ecology's requirements with regard to compliance with groundwater cleanup levels are:

- compliance with a cleanup standard shall be determined for each monitoring well [WAC 173-340-720(8)(c)(iv)].

- For cleanup levels based on short-term or acute toxic effects on human health or the environment, an upper percentile concentration shall be used to evaluate compliance with groundwater cleanup levels [WAC 173-340-720(8)(c)(v)(A)].

- For cleanup levels based on chronic or carcinogenic threats, the mean concentration shall be used to evaluate compliance with groundwater cleanup levels unless there are large variations in concentrations relative to the mean concentration or a large percentage of concentrations below the detection limit [WAC 173-340-720(8)(c)(v)(B)].

Therefore, the confidence interval approach should be used for cleanup levels based on chronic or carcinogenic effects, and the tolerance interval approach should be used for cleanup levels based on short-term or acute toxic effects. Additionally, other statistical methods approved by Ecology are also acceptable [WAC 173-340-720(8)(d)(iii)].

The confidence interval and tolerance interval methods should not be performed on data that cannot be approximated by a normal or lognormal distribution. A non-parametric method should be used for such types of data.

In addition to comparing site data to the cleanup standard, there are two other requirements that must be met before a site can be determined to be clean [WAC 173-340-720(8)(e) and (f).

- No single sample concentration shall be greater than 2 times the groundwater cleanup level; and

- Less than 10% of the sample concentrations shall exceed the groundwater cleanup level during a representative sampling period.

For background-based standards, adjustments to these criteria should be considered (see Figure A-2-5). Table A-2-6 provides a summary on Ecology's requirements in calculating a value for assessing compliance with a groundwater cleanup standard.

Evaluation and Discussion of Ecology's Method in Assessing the Attainment of Cleanup Standards. Ecology has stated that "Once a numerical cleanup standard has been selected, whether based on risk-equivalent concentrations, ARARs, ecologically protective levels, natural or area backgrounds, or other criteria, the evaluation of compliance monitoring data with respect to the cleanup standard proceeds in exactly the same way. The fact that a numerical cleanup standard has been derived based on background data does not affect the types of evaluations of compliance monitoring data." It is also stated that "In all cases, a single numerical value is obtained for the cleanup standard, to which site data can be compared." In our opinion, the process of evaluating compliance data depends on whether the standard is background-based or not because of the following reasons:

Figure A-2-5. Flowchart Overview for Determining that Groundwater at a Site Meets a Background-Based Cleanup Standard-Modified after Ecology 1992.

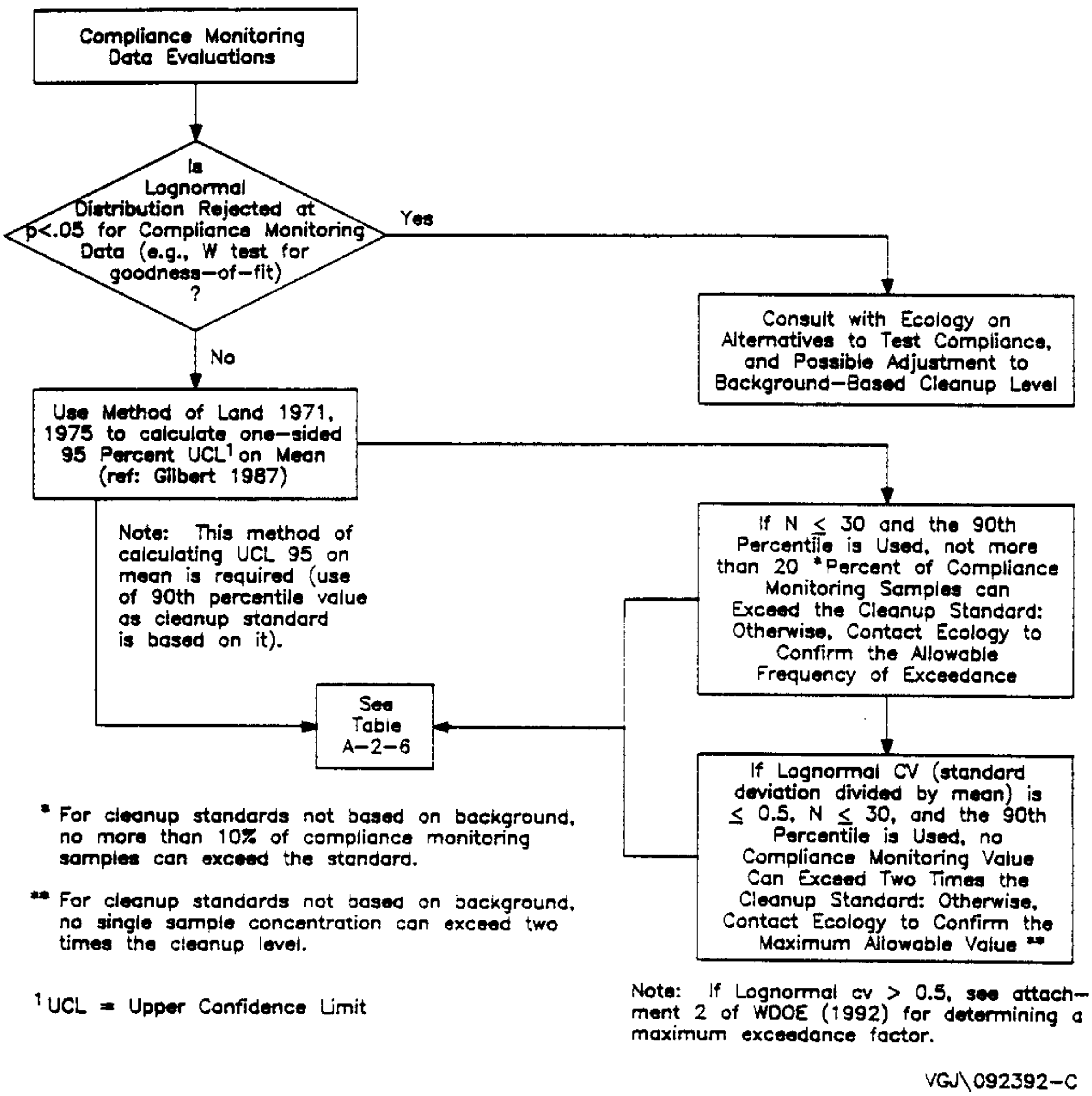


Table A-2-6. Summary of How to Calculate a Value for Comparison With a Cleanup Standard[b]. Source: Ecology (1992)

Site Data Distribution	Toxic Effects	Groundwater
Log-normal (Default)	Chronic	Upper 95% confidence limit (CL) using Land's method (see Gilbert 1987, page 170)
	Short Term/Acute	Upper 95% tolerance limit (TL) on the 50th percentile (median)
Normal	Chronic	Upper 95% CL on mean
	Short Term/Acute	Upper 95% CL on mean
Neither Log-normal nor Normal ($n \leq 20$)	Chronic	· Upper 95% TL (non-parametric) on site-specific percentile[a] using procedure described in Conover (1980, page 112) · May consider obtaining additional samples
	Short Term/Acute	· Upper 95% TL on median · May consider obtaining additional samples
($n>20$)	Chronic	· Upper 95% CL on site-specific percentile[a] · Upper 95% CL using large sample approximation based on the central limit theorem[a]
	Short Term/Acute	Upper 95% CL on median

[a]Requires consultation with Ecology.
[b]Additional Requirements: When cleanup standard is not based on background, other compliance criteria are:

- No single value more than twice the cleanup standard; and
- No more than 10% of values greater than cleanup standard.

When cleanup standard is based on background, different criteria may apply (see Figure A-2-5).

- The hypothesis is an assumption about a property or characteristic of a population under study. Before a statistical test is performed it is necessary to clearly specify the null hypothesis and the alternative hypothesis. The goal of the statistical inference is to decide which of the two complementary hypothesis is likely to be true.

- The null hypothesis that contaminant concentrations at the site exceed the cleanup level (i.e., the site is "dirty") and the alternative hypothesis is that the site is "clean" are appropriate for a comparison with a risked-based standards or in such case that the site is known to be contaminated. However, when the cleanup standards are background-based, the hypotheses should be the reverse of those given.

- When the standards are based on risks, ARARs, ecologically protective levels, etc., the statistical test is a one-sample case (i.e., evaluating the site data vs a constant or a fixed value). However, when the standards are based on background, the statistical test is a two-sample case (i.e., evaluating the site data vs background data).

- In order to define a statistical test to determine if the contaminant concentrations in groundwater well(s) attain the cleanup standard, the characteric of the concentrations which is to be compared to the cleanup standard must be specified. For example, if this characteric is determined to be mean (or median) concentration then a statistical tests on the mean (or median) can be designed and carried out. When this character is determined to be a specified percentile then a statistical test on percentile can be performed.

- The use of a single numerical value as a background-based cleanup standard discards away important information. Background for a particular constituent of concern should be considered as a statistical distribution of concentration levels. To treat these background-based standards as constants (known without error) may result in excessive or unnecessary remediation (Gilbert and Simpson 1990).

Hence, whether the standard is based on background affects not only the way the hypotheses are stated but also the statistical tests (one-sample test or two-sample test) to be performed.

After groundwater at a CERCLA/RCRA site has been remediated, it is necessary to determine whether the remediation effort has been successful (i.e., verification of cleanup). This determination should be statistically based, using appropriate sampling designs and tests. Appropriate statistical tests may include the Wilcoxon Rank Sum (WRS) and/or Quantile test depending on the types of contamination scenarios (Gilbert and Simpson 1990). If the remediation action has "uniformly" reduced contamination levels, but not to background levels, the WRS test should be used because it has greater power than the quantile test. However, if most of the cleanup unit has been remediated to background levels and only a few "hot spots" remain, the quantile test is preferred. Additionally, if more than 40% of the background samples are non-detects then the quantile test should be used. Procedures to carry out the WRS test and the quantile test are in Gilbert and Simpson (1990).

Another approach to test the attainment of background-based cleanup standards is to: 1) treat background threshold values (90th percentile for a log-normal distribution, 80th percentile for a normal distribution, etc.) as known constants (known without error); and 2) use compliance sampling or acceptance sampling tests. However, the draw back is that the α level will be greater than specified, say 5%, when assuming the parameter is a constant (see Gilbert and Simpson 1990). Excessive or unnecessary remediation may result in such cases. For this reason, using a threshold value as if it were a constant is not recommended for attainment testing (Gilbert and Simpson 1990).

A-2.5 ISSUES RELATED TO THE ASSESSMENT OF GROUNDWATER CLEANUP ATTAINMENT.

The Contaminants To Be Tested. In general, contaminants will be identified at the site prior to remedial action. Due to physical, chemical, and biological changes in soil and groundwater, a few chemicals should be selected as indicators or primary contaminants to assess the attainment of cleanup standards. The criteria for selecting these indicator parameters may depend on factors such as expected concentrations, association with other chemicals, cost of analytical analysis, detection limits, and the presence of off-site upgradient sources of contaminants. Decisions on which chemicals are to be used to assess attainment should be based on expert knowledge of the site and its groundwater. Inclusion of all potential contaminants in assessing attainment is ineffective (i.e., very poor power) and costly. It should also noted that in order to actually apply cleanup standards to groundwater remediation at the Hanford Site, it may be necessary to begin with the most upgradient source(s). Thus an integrated, site-wide approach to remediation would be needed.

The Time Period For Assessing Attainment. Concentrations of constituents of concern in groundwater are measured from samples collected from wells at specified times. For assessing the attainment of groundwater cleanup standards, the period of time over which sampling occurs must carefully selected. Otherwise, sampling may have done forever. Clearly, if there are unidentified present or future sources of contamination, the groundwater (even it is clean now) may be contaminated sometime in the future. For example, upgradient plumes could migrate into an area that has been remediated. In the absence of other sources of contamination, groundwater that has attained the cleanup standard should continue to attain the standard. If the future conditions at the site are likely to be similar to the current conditions, it may be reasonable to conclude that future concentrations will be similar to the concentrations found in the sample. However, follow-up monitoring is needed to determine if there may be some unexpected problems. At least 1 or 2 years of quarterly followup monitoring may be needed for this purpose. However, the length of the period for followup monitoring has to be negotiated.

Assessing Wells Individually Or Testing Wells As A Group. There are two ways to judge the attainment of the groundwater cleanup standards: 1) assess each well individually (i.e., make a separate attainment decision for each well); concluding that the groundwater at the site attains the cleanup standard only if the groundwater in each well attains the cleanup standard and (2) assess all wells as a group.

Individual well comparison is required under MTCA [WAC 173-340-720(8)(c)(iv)]. However, as more wells and more chemicals are tested, the overall Type I error (false positive) rate will increase, resulting in a non-attainment decision. For example, if a particular site has 10 monitoring wells and 4 contaminants of concern. There are 40 comparisons (10 wells x 4 chemicals) to be made. Using a 5% Type I error rate for each individual comparison, the probability of failing at least one in the 40 statistical comparisons is:

$$1 - (1 - 0.05)^{40} = 1 - 0.1285 \approx 0.87$$

Hence, the overall false positive rate is about 87%. This means, when the site really is clean (the true state of nature), the probability of making at least one error (i.e., indication of a non-attainment decision) is about 87%. When the number of comparisons is 100 (say 20 wells and 5 chemicals), the overall false positive rate is more than 99%. One possible remedy is to uses Bonferroni's inequality and substituting α by α/k, where k is the number of comparisons to be made when calculating the CL on means (or medians). Another possible remedy is to assess wells as a group, and perform statistical tests (such as parametric or non-parametric Analysis of Variance, WRS test, Quantile test, etc.) Finally, in case of an initial exceedance and/or statistical significant test result, verification sampling must be allowed.

The above considerations emphasize the importance of choosing an appropriate statistical test early in the planning stage for groundwater cleanup or corrective actions.

A-2.6 SUMMARY AND CONCLUSIONS

Results of the application of Ecology guidance to the arsenic test case, and associated discussion, suggests use of the guidance could result in unnecessary groundwater remediation. For this reason, development of alternative site-specific guidance for Hanford is warranted. This will involve consideration of spatial variability of natural background and will require acquisition of background data from additional locations.

To effectively collect and utilize groundwater monitoring data in the four programmatic areas at the Hanford Site, the background region should be selected from area(s) free from contamination and similar to the test site in physical, chemical, or biological characteristics. Furthermore, concentrations of chemicals in groundwater vary considerably depending on factors such as soil characteristics, proximity to recharge and discharge areas, and flow rates. Therefore, background must be considered as a statistical distribution of concentration levels, rather than a single concentration.

The values listed in Table A-1-2 (see attached) should be used only for preliminary screening purpose. Constituent concentrations at a specific site can be visually compared to these values. If they appear to be outside the range of naturally occurring concentrations indicated in Table A-1-2, a more detailed evaluation is recommended using the complete background data set for constituent of concern. Appropriate statistical tests include: Wilcoxon rank sum test, Quantile test, hot spot comparisons, and Komogorov-Smirnov type of test, etc.

When making contamination and/or remediation decisions about a waste site all available information must be used. In addition to statistical test procedures, geochemical and hydrologic considerations are integral parts of a decision process. A phased approach, as shown in Figure A-2-6, is recommended. The phases proceed from simple to the more complex, and from an overview to detailed analysis. All phases should be completed and evaluated before a decision is reached. Work is in progress toward this approach.

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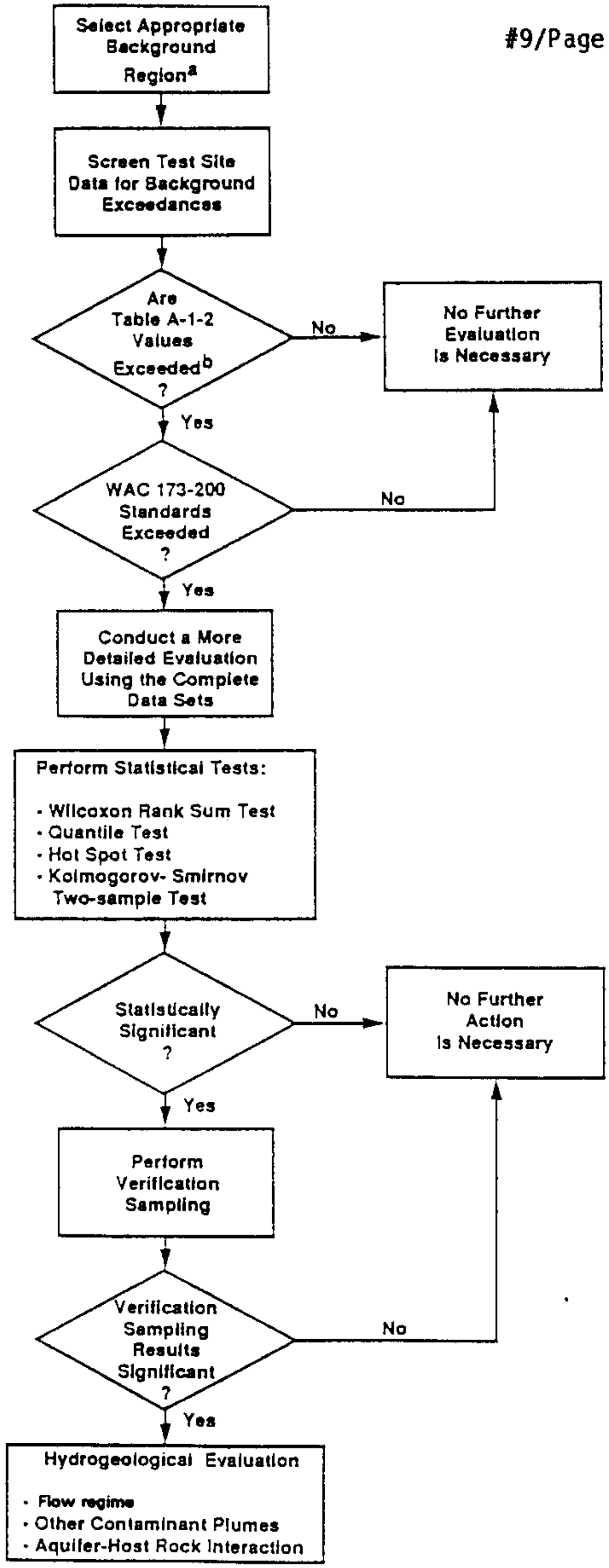
W.S. DOE, 1992, Statistical Guidance for Ecology Site Managers, Washington State Department of Ecology, Olympia, Washington.

Figure A-2-6. An Overview of Suggested Phased Approach.



[a]Concensus Among DOE, WHC, EPA, and Ecology (Work In Progress)

[b]Ecology Allows a 20% Exceedance of Background Based Standards

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ATTACHMENT

APPENDIX A-1: PROVISIONAL NATURAL GROUNDWATER BACKGROUND VALUES FOR HANFORD SITE

Table A-1-2 provides a summary of provisional natural background values for Hanford Site groundwater (DOE/RL-92-23). The values are from various existing data sources as indicated in the column headings and footnotes to the table.

The first column lists the constituents alphabetically. Some constituents are designated as high or low to indicate there is more than one population group for that constituent. Judgement and other site information must be used in these cases (e.g., locations such as along the river or where cooling water dilution of groundwater may occur, presence or absence of oxygen because natural reducing conditions may result in elevated metals, etc.).

Columns 3, 4, and 5 provide the mean and one standard deviation from the sources indicated. Where available, the sample size used to calculate the mean and standard deviation is indicated in parentheses.

The Pacific Northwest Laboratory (PNL) results are based on approximately 50 wells selected from across the Hanford Site from locations outside known contamination plumes. The U.S. Geological Survey (USGS) values shown are based on 7 well locations in an upgradient corridor running parallel to Rattlesnake Ridge (Figure A-1-1). The Westinghouse Hanford values are based on 17 wells located in the Rattlesnake Ridge corridor and were combined from the Basalt Waste Isolation Project (BWIP) Hydrochemistry Data Base and the Hanford Groundwater Data Base (DOE/RL-92-23). Examination of the 6-7 quarters of sampling results from the BWIP data set suggested there was little if any evidence of autocorrelation or seasonal effects. In these cases, Ecology (Ecology 1992) guidance allows multiple results from a single well to be combined; i.e., treated as independent samples for computational purposes. Thus the sample size indicated in parentheses is larger than the number of wells from which the data set was derived for both the USGS and Westinghouse Hanford columns.

The fifth column represents the estimate of the upper 95% confidence limit on the 95th percentile of the natural background distributions. The new state guidance applies a different set of rules for this calculation for deriving cleanup standards that will result in lower estimates than shown here (see Appendix A-2 discussion).

Table A-1-2. Summary of Provisional Hanford Site Groundwater Background Values[a]. (sheet 1 of 4)

Constituent (Conc.)	PNL Results[b]	USGS Results[b] (Sample Size)	WHC Unconfined[b] (Sample Size)	WHC Provisional Threshold Values
Aluminum (ppb)	<2	110±139 (12)	<200 (50)	<200
Ammonium (ppb)	<50	N.A.	<50 (18)	<120
Arsenic (ppb)	3.9±2.4	6.7±3.7 (7)	<5 (14)	10
Barium (ppb)	42±20	53±14 (11)	41±20 (53)	68.5
Beryllium (ppb)	<0.3	N.A.	<5 (16)	<5
Bismuth (ppb)	<0.02	N.A.	<5 (4)	<5
Boron (ppb)	<50	<50 (14)	<100 (35)	<100
Cadmium (ppb)	<0.2	<10 (1)	<10 (16)	<10
Calcium (ppb)	40,400±10,300	40,857±8,282 (14)	38,542±11,023 (53)	63,600
Chloride-Low (ppb)	N.A.	5,825±1,355 (8)	5,032±1,774 (53)	8,690
Chloride-High (ppb)	N.A.	20,667±2,503 (6)	23,296±2,463 (14)	28,500
Chloride-All (ppb)	10,300±6,500	12,186±7,842 (14)	8,848±7,723 (67)	N.C.
Chromium (ppb)	4±2	<50 (11)	<30 (8)	<30

[a]Source: From Tables 5-9 and 5-11 (DOE/RL-92-23).
[b]Results shown are mean ± one standard deviation.
*Potential outlier observation(s) were removed.
N.A. = not available. N.C. = not calculated. N.D. = not detected.

Table A-1-2. Summary of Provisional Hanford Site Groundwater Background Values[a]. (sheet 2 of 4)

Constituent (Conc.)	PNL Results[b]	USGS Results[b] (Sample Size)	WHC Unconfined[b] (Sample Size)	WHC Provisional Threshold Values
Copper (ppb)	<1	<10 (10)	<30 (50)	<30
Fluoride (ppb)	370 ± 100	550 ± 330 (14)	437 ± 131* (47)	1,340 775*
Iron-Low (ppb)	N.A.	22 ± 16* (13)	<50 (34)	86
Iron-Mid (ppb)	N.A.	N.A.	115 ± 52 (7)	291
Iron-High (ppb)	N.A.	N.A.	494 ± 118 (12)	818
Iron-All (ppb)	N.A.	N.A.	149 ± 199 (53)	N.C.
Lead (ppb)	<0.5	<30* (6)	<5 (15)	<5
Magnesium (ppb)	11800 ± 3400	$10,814 \pm 1,813$ (14)	$11,190 \pm 2,578$ (53)	16,480
Manganese-Low (ppb)	N.A.	26 ± 27 (8)	<20 (33)	24.5
Manganese-Hgh (ppb)	N.A.	150 ± 87 (3)	118 ± 17 (20)	163.5
Manganese-All (ppb)	7 ± 5	60 ± 73 (11)	50 ± 55 (53)	N.C.
Mercury (ppb)	<0.1	N.A.	<0.1 (14)	<0.1
Nickel (ppb)	<4	<50 (14)	<30 (23)	<30

[a]Source: From Tables 5-9 and 5-11 (DOE/RL-92-23).
[b]Results shown are mean ± one standard deviation.
*Potential outlier observation(s) were removed.
N.A. = not available. N.C. = not calculated. N.D. = not detected.

Table A-1-2. Summary of Provisional Hanford Site Groundwater Background Values[a]. (sheet 3 of 4)

Constituent (Conc.)	PNL Results[b]	USGS Results[b] (Sample Size)	WHC Unconfined[b] (Sample Size)	WHC Provisional Threshold Values
Nitrate (ppb)	N.A.	3,224±3,380 (13)	5,170±3,576 (78)	12,400
Phosphate (ppb)	<1,000	140±62 (3)	<1,000[f]	<1,000
Potassium (ppb)	4,950±1,240	5,900±1,253 (14)	4,993±1,453 (53)	7,975
Selenium (ppb)	<2	N.A.	<5 (14)	<5
Silver (ppb)	<10	N.A.	<10	<10
Silicon (ppb)	N.A.	16,786±3,683 (14)	18,152±4,974 (35)	26,500
Sodium (ppb)	18,260±10,150	20,286±7,907 (14)	15,774±6,784 (53)	33,500
Strontium (ppb)	236±102	159±78 (14)	164±47 (43)	264.1
Sulfate (ppb)	34,300±16,900	41,286±27,880 (14)	30,605±22,611 (67)	90,500
Uranium (pCi/l)	1.7±0.8	N.A.	1.7±1.2 (10)	3.43
Vanadium (ppb)	17±9	N.A.	9±4 (18)	15
Zinc-Low (ppb)	N.A.	14±20 (11)	<50 (36)	<50
Zinc-High (ppb)	N.A.	373±284 (3)	247±165 (17)	673

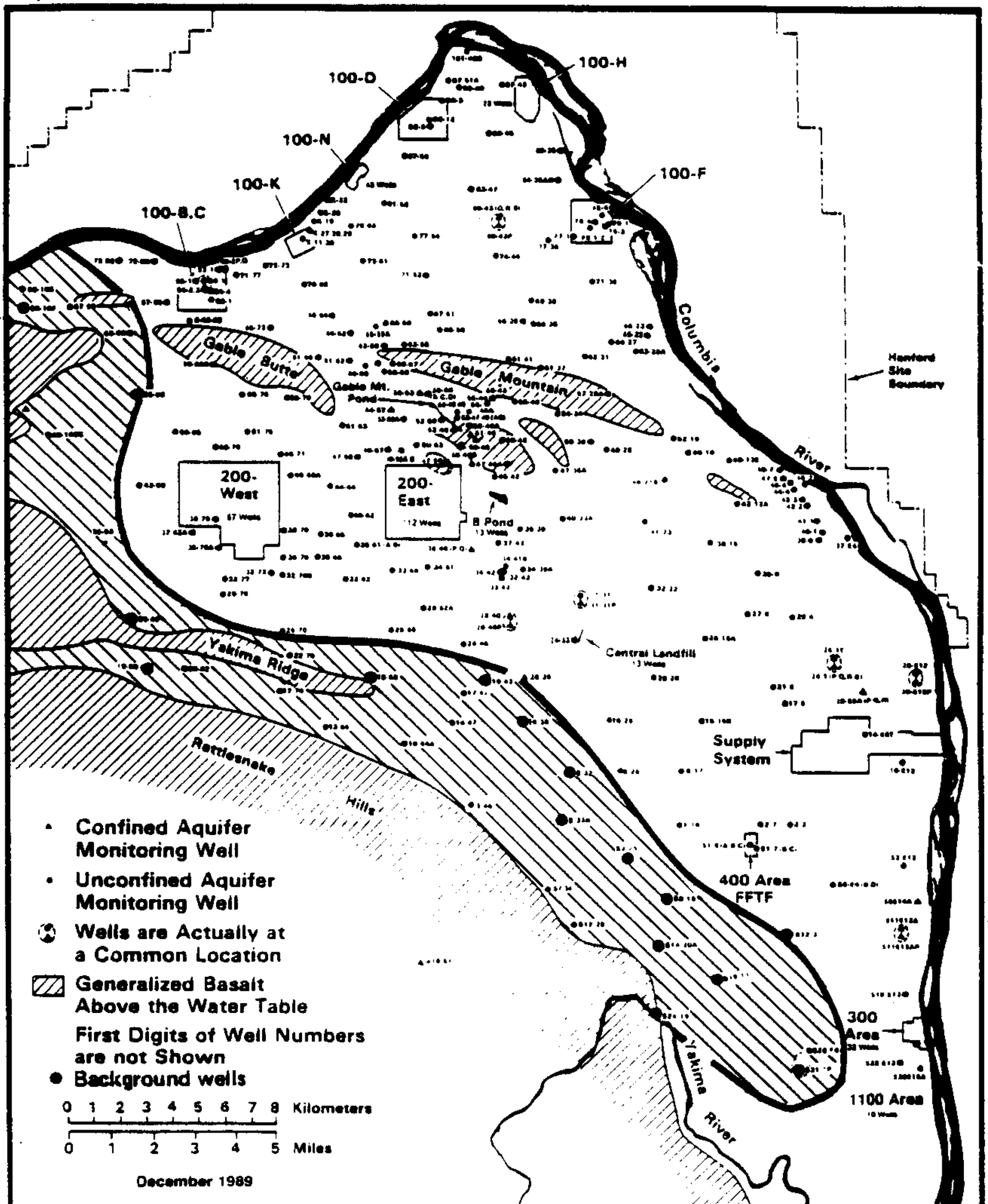
[a]Source: From Tables 5-9 and 5-11 (DOE/RL-92-23).
[b]Results shown are mean ± one standard deviation.
[f]Potential outlier observation(s) were removed.
N.A. = not available. N. C. = not calculated. N.D. = not detected.

Table A-1-2. Summary of Provisional Hanford Site Groundwater Background Values[a]. (sheet 4 of 4)

Constituent (Conc.)	PNL Results[b]	USGS Results[b] (Sample Size)	WHC Unconfined[b] (Sample Size)	WHC Provisional Threshold Values
Zinc-All (ppb)	6±2	91±190 (14)	95±140 (53)	N.C.
Field Alk. (ppb)	N.A.	134100±20469 (10)	137,758±33,656 (31)	215,000
Lab Alk. (ppb)	123000±21000	130,000±8,165 (4)	133,717±29,399 (52)	210,000
Field pH	N.A.	N.A.	7.57±0.29 (57)	[6.90, 8.24]
Lab pH	7.64±0.16	N.A.	7.75±0.21 (52)	[7.25, 8.25]
TOC (ppb)	586±347	N.A.	519±367* (62)	2,610 1,610*
Field Cond. (umho/cm)	N.A.	N.A.	344±83 (22)	539
Lab. Cond. (umho/cm)	380±82	N.A.	332±93 (36)	530
TOX,LDL (ppb)	N.A.	N.A.	<20* (14)	60.8 37.6*
Total Carbon (ppb)	N.A.	N.A.	31,772±7,022 (48)	50,100
Gross Alpha (pCi/l)	2.5±1.4	N.A.	2.5±1.5* (36)	63 5.79*
Gross Beta (pCi/l)	19±12	N.A.	7.1±2.6* (44)	35.5 12.62*
Radium (pCi/l)	<0.2	N.A.	N.D. (10)	0.23

[a]From Tables 5-9 and 5-11 (DOE/RL-92-23).
[b]Results shown are mean ± one standard deviation.
*Potential outlier observation(s) were removed.
N.A. = not available. N. C. = not calculated. N.D. = not detected.

Figure A-1-1. Background Well Locations in Rattlesnake Ridge Corridor.



UNIT MANAGERS MEETING
Wednesday, March 24, 1993, 740 Steven Center/Room 1200

RISK ASSESSMENT WORKING GROUP
R. K. Stewart/S. W. Clark

1. Revision of Hanford Site Baseline Risk Assessment Methodology - Changes to the text of Revision 2 of the Hanford Baseline Risk Assessment Methodology (HSBRAM), DOE/RL-91-45, were agreed upon in meetings of members of the Inter-Agency Risk Assessment Committee (RAC) in Bellevue, WA on March 9 & 10, 1993. This clears the way to publish Revision 2 of the HSBRAM at the end of March 1993. Publication of Revision 2 will make the HSBRAM available as a reference for reviewers of all RI reports and QRAs scheduled for delivery to RL and the regulatory agencies, beginning with the Phase I Remedial Investigation report of the 200-BP-1 operable unit at the end of March 1993.

2. 100 Area Qualitative Risk Assessments - Qualitative risk assessments for source operable units (100-BC-1, 100-DR-1, 100-HR-1) and groundwater operable units (100-BC-5, 100-HR-3) are being written for presentation during the April-May 1993 timeframe.

3. Probabilistic Baseline Risk Assessment Demonstration - A workshop was held by the U.S. Army Corps of Engineers and the U.S. Department of Energy Richland Field Office on March 9 & 10, 1993, in Bellevue, WA, to develop agreed-upon parameter distributions for the probabilistic baseline risk assessment demonstration for the 1100-EM-1 operable unit. The workshop was attended by a cross section of government and contractor organizations who perform and review human health and ecological risk assessments. All input parameters and the form of all distributions for a demo probabilistic assessment of the 1100-EM-1 operable unit were reviewed and agreed upon. The discussions benefited greatly from interactive computer software which allowed the distributions being discussed to be viewed on a projection screen and changes made as the workshop participants came to a concensus. Minutes of the workshop will be provided.

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March 24, 1993

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